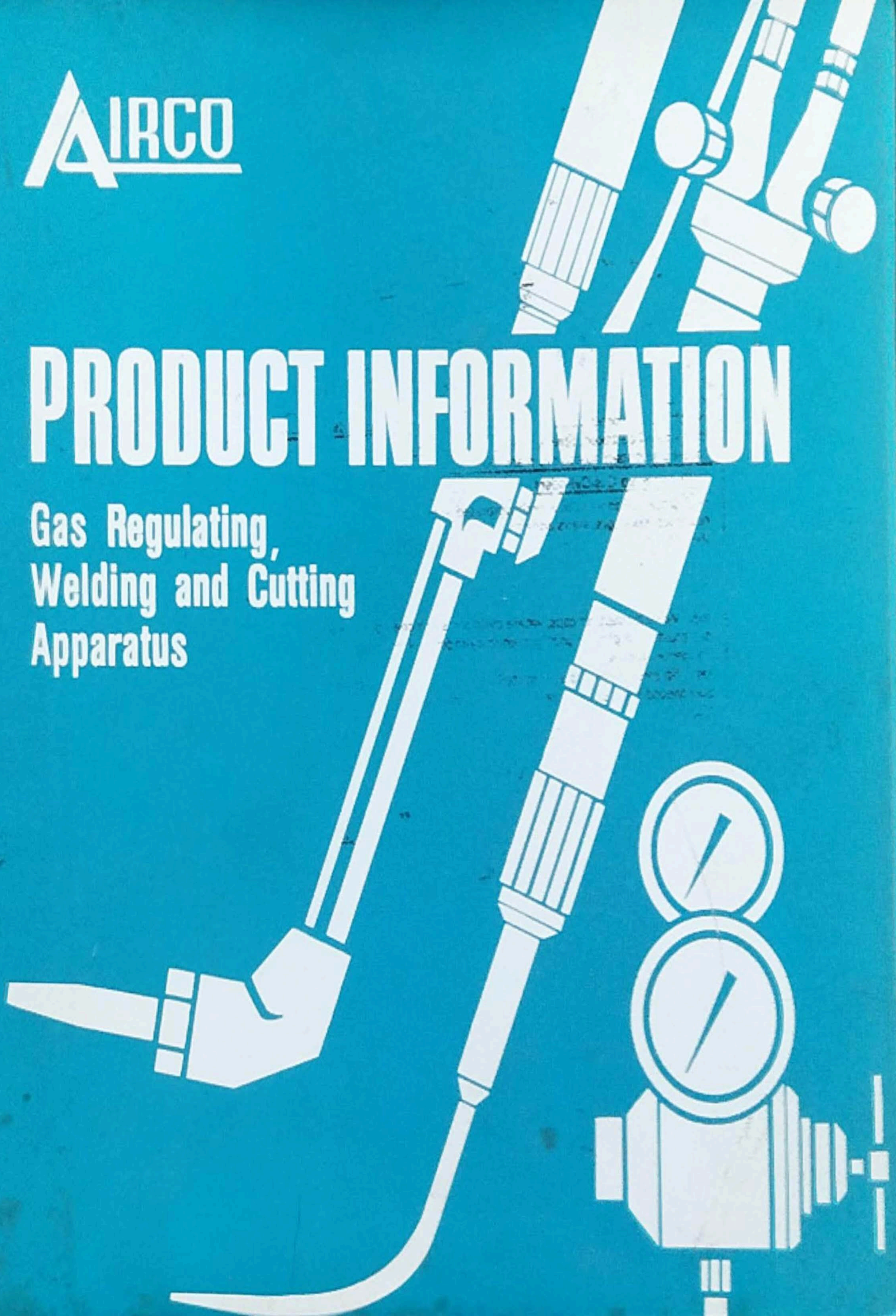
AIRCO

PRODUCT INFORMATION

Gas Regulating, Welding and Cutting Apparatus



AIRCO Welding Products

PRODUCT INFORMATION
GAS REGULATING, WELDING AND CUTTING APPARATUS
CLASS 8

TRAINER'S GUIDE

AUGUST 1976

PRODUCT INFORMATION GAS REGULATING, WELDING AND CUTTING APPARATUS

PURPOSE:

The purpose of this program is to instruct any individual on the total Class 8 product line which consists of gas regulating, welding and cutting apparatus and related processes.

AIM:

To have each participant learn as much material as possible and achieve 100% on all tests and applied exercises. It is expected that after the imparting of this general information and technical knowledge the participant will become confident in the selling of Class 8 products.

GENERAL OBJECTIVES:

1. To take into account the various levels of knowledge between a newcomer and an experienced person, each topic begins with basic information followed by more advanced subject matter.
2. To provide material which can be presented in the Training Centers by the Training Center Managers, or presented in-store by the Airco Sales Engineer, or Technical Application Representative to the Distributor personnel.
3. To provide a standardized training package which will enable all trainers to present the same material using the same methods at all locations.
4. To provide tests which will determine the participant's understanding of the subjects.
5. To make comparisons between Airco's Class 8 product line and competitors' similar products.
6. To help trainers create a professional atmosphere which is conducive to learning.
7. To stress how the material learned can be applied to selling.

TRAINING TECHNIQUES

I. Methods of Presentation
  - A. Lecture
  - B. Question and Answer
  - C. Visual Aids
  - D. Group Discussion
  - ~~E. Study Time~~
  - E. F. Tests AND APPLIED EXERCISES
  - F. ~~G.~~ Demonstrations

A. Lecture
  1. Organization—logical, easy to follow
     - a. Lesson Plans—all material which will be presented has been organized in the form of a lesson plan. A lesson plan includes the subject, objectives, references, training materials and the presentation.
     - b. The presentation pages are divided. The trainer's instructions appear on the left side of the page. The material to be presented is on the right side in outline form. Detailed text material is included in each section and should be reviewed by the trainer before the presentation.
  2. Do not read the outline word for word. Let it be your guide.
  3. Clear explanation of points.
  4. Emphasis on key points.
  5. Speech techniques:
     - a. Rate—not too slow, not too fast.
     - b. Volume—be sure you can be heard.
     - c. English usage—grammatically correct and professional.
  6. Talk about material to be covered and not unrelated experiences.
  7. Be sure you are understood.

B. Questions and Answers
  1. Whenever possible ask questions which will be answered on a voluntary basis. This technique will encourage group participation and will vary the method of presentation.

C. Visual Aids
  1. Review all slides so you can explain them and relate them to the lesson.
  2. Whenever possible use actual products to supplement the lesson.
  3. Chalkboard
     - a. Plan its use in advance.
     - b. Print and draw legibly.
  4. Video Tapes
     - ~~a. When demonstrations of the oxy-fuel processes are not possible, use Video Tapes No. 6, 7, 8, and 10 of the *MAPP Gas Series*.~~
     - ~~b. A Video Tape can be shown during each coffee break, recognizing that some participants have either seen these tapes or they may have had experience using the oxy-fuel processes.~~
     - c. Schedule — See below.

~~DAY~~	~~TAPE NO.~~	~~TITLE~~	~~TIME~~
~~1st A.M.~~	~~6~~	~~Equipment Set-up and Shut-Down~~	~~20 Min.~~
~~1st P.M.~~	~~7~~	~~Light-up and Flame Adjustment~~	~~24 Min.~~
~~2nd A.M.~~	~~8~~	~~Cutting, Piercing, Beveling~~	~~27 Min.~~
~~2nd P.M.~~	~~10~~	~~Welding, Brazing, Silver Brazing~~	~~10 Min.~~

D. Group Discussion

1. Encourage participation from all participants.
    a. Don't let a few people dominate the discussion.
2. Discussion should always by related to the material covered. Trainer's responsibility includes guiding discussion to keep on target.
    a. It is the responsibility of the trainer to provide answers to unresolved questions that have come up during the program.

~~E. Study Time~~

1. ~~Subject groups are formed which are designed to meet individual needs.~~
2. ~~The trainer selects a participant as a leader for each group. Trainer should rotate from one group to another to answer questions.~~

E. ~~F.~~ Tests AND APPLIED EXERCISES

1. The purpose of the tests is to determine if the participant understood the material.
2. Everyone should achieve 100%.
3. Each participant should grade his own test.
4. Brief review of material which needs clarification.

F. ~~G.~~ Demonstrations

1. ~~During the Coffee Break in the morning of the third day a live demonstration of hand flame cutting can be used. The idea being to have those participants who have not experienced the "feel" of hand cutting to try their hand at it.~~
2. Before the demonstration
    a. Select an appropriate area.
    b. Set-up and check your equipment.
    c. Plan the demonstration.
        (1). Demonstrate only once to the group. Point out what pressures are being used, the type of flame and how to start the cut and how to maintain the cut.

        Change

        (2). Give each participant an opportunity to make a short ~~cut~~. WELD.

LESSON PLAN

SUBJECT: ORIENTATION

OBJECTIVE:

1. To discuss the overall description, purpose, and aim of the Training Program.
2. To review the agenda.
3. To discuss the procedure in presenting the program.

REFERENCES Product Information—Class 8 Text, Section on Orientation.

TRAINING MATERIALS:
Product Information—Class 8 Text, Section on Orientation.
First day material
SECTION A, B, C, and D
Transfer learning into Selling — 1

PRESENTATION:

The purpose of this training program is to instruct you on the total Class 8 product line gas regulating, welding and cutting apparatus and related processes. The program consists of general and technical information.

In this class there may be varying levels of knowledge regarding Class 8 apparatus because of past work experiences. We will begin each subject area with basic information followed by more advanced subject matter in the text.

HAND OUT BINDER AND FIRST DAY MATERIAL WHICH INCLUDES SECTION ON ORIENTATION, SECTIONS A, B, C, D, AND TRANSFER LEARNING INTO SELLING - 1.

This program is a standardized program which is being presented in all of the Airco Training Centers, and at in-store locations.

There are eleven sections to the Product Information — Class 8 text. We will now distribute the sections to be covered today. Insert this first day material in the binder.

SEE AGENDA IN SECTION ON ORIENTATION. STOP FOR ONE MINUTE AND LET EVERYONE REVIEW FOR THEMSELVES.

We will now review the agenda (see Page O4). The procedure we will use in presenting this program is simply one of lecture, questions and answers asked during the presentation of the subject material, and group discussions. There are tests on each section to determine your understanding of the material. After the tests you will check your answers and we will discuss the correct answers. The objective is that each participant fully understands the material and achieves a perfect score of 100%.

At the end of the program there will be one final test, corrected by the trainer. The results will be forwarded to the Distributors along with your Certificate of Achievement.

Homework assignments will be issued at the end of the day. They will be based on material covered ~~during the previous~~ that day.

Video Tape demonstrations on oxy-fuel processes will be shown during coffee breaks. On the third day, in the morning coffee break, there will be a live demonstration on hand flame cutting for those participants who have not tried to flame cut.

CONCLUSION:

To summarize this Section on Orientation, we have discussed the overall description of the program, reviewed the agenda, and discussed the procedure we will follow in the remainder of this program.

AGENDA

FIRST DAY/A.M.

8:30 — 8:45
ORIENTATION

8:45 — 9:15
SECTION A: COMBUSTION THEORY

9:15 — 10:00
SECTION B: GAS SUPPLY SYSTEMS

10:00 — 10:30
COFFEE BREAK — Viewing Video Tape No. 6 Set Up and Shut Down Oxy-fuel Equipment MAPP Gas Series

10:30 — 11:00
GAS SUPPLY SYSTEMS Continued

11:00 — 12:00
SECTION C: GAS REGULATORS

12:00 — 1:00
LUNCH

FIRST DAY/P.M.

1:00 — 2:30
SECTION D: THE AIRCO REGULATOR LINE

2:30 — 3:00
COFFEE BREAK — Viewing Video Tape No. 7 Light Up and Flame Adjustment MAPP Gas Series

3:00 — 4:00
AIRCO REGULATOR LINE Continued

4:00 — 4:30
GROUP DISCUSSION — TRANSFER LEARNING INTO SELLING — 1

4:30
HOMEWORK ASSIGNMENT — REVIEW TEXT
Section A: Combustion Theory
Section B: Gas Supply Systems
Section C: Gas Regulators
Section D: Airco Regulator Line
Study for Test on material presented in Class (Except Video Tape).

AGENDA

SECOND DAY/A.M.

8:30 — 9:00
TEST, Score your own Test.

9:00 — 9:30
STUDY TIME for review of material not understood.

9:30 — 10:00
SECTION E: HOSE AND CONNECTIONS

10:00 — 10:30
COFFEE BREAK — Viewing Video Tape No. 8 Flame Cutting, Piercing, Beveling, MAPP Gas Series.

10:30 — 12:00
SECTION F: TORCHES

12:00 — 1:00
LUNCH

SECOND DAY/P.M.

1:00 — 2:00
SECTION G: TORCH TIPS AND APPLICATIONS

2:00 — 3:00
SECTION H: WELDING AND CUTTING OUTFITS

3:00 — 3:15
COFFEE BREAK — Viewing Video Tape No. 10 Welding, Braze Welding, Silver Brazing MAPP Gas Series.

3:15 — 4:00
SECTION H: WELDING AND CUTTING OUTFITS Continued.

4:00 — 4:30
GROUP DISCUSSION — TRANSFER LEARNING INTO SELLING — 2

4:30 —
HOMEWORK ASSIGNMENT — Review Text

Section E: Hose and Connections
Section F: Torches
Section G: Torch Tips and Applications
Section H: Welding and Cutting Outfits
Glossary of Terms
Study for Test on material presented in Class (Except Video Tape).

AGENDA

THIRD DAY/A.M.

8:30 — 9:00
TEST, Score your own test.

9:00 — 9:30
STUDY TIME for review of material not understood.

9:30 — 10:00
SECTION I: ACCESSORIES

10:00 — 10:15
COFFEE BREAK — Demonstration Hand Flame Cutting.

10:15 — 10:30
SECTION J: PROPORTIONERS

10:30 — 11:00
SECTION K: SMALL MACHINES

11:00 — 11:30
POSITIVE ACTION PLAN

11:30 — 12:00
FINAL TEST

PRODUCT INFORMATION
GAS REGULATING, WELDING AND CUTTING APPARATUS

SUBJECT OUTLINE

SECTION A: COMBUSTION THEORY

1. Fuels
2. B.T.U.
3. Oxygen Ratio
4. Heat Transfer
5. Flame Velocity
6. Basic Oxy-fuel Equipment

SECTION B: GAS SUPPLY SYSTEMS

1. High Pressure Gas Cylinders
    a. Color Code of Cylinders
    b. Compressed Gas Association
2. Oxygen and Oxygen Cylinders
3. Acetylene and Acetylene Cylinders
4. MAPP Gas, LP Gases and Tanks
    a. Withdrawal Rates
5. Gas Manifolds and Manifolding of Cylinders.
6. Gas Distribution Systems and Safety Standards.
7. Pipeline Accessories

SECTION C: GAS REGULATORS

1. How It Works
2. Single-Stage
3. Two-Stage
4. Performance Terms

SECTION D: THE AIRCO REGULATOR LINE

1. Stock Number Identification
2. Cylinder Regulators
3. Pipeline and Station Regulators
4. Light Duty Regulators
5. Specialty Regulators
6. Two-Stage Regulator
7. Comparison With Competition
8. Single-Stage Regulator

SECTION E: HOSES AND CONNECTIONS

1. Pressure Drop
2. Torch Entry Pressures
3. Airco Twin Hose
4. Airco Single Line Hose

SECTION F: TORCHES

1. Air Fuel Torches
2. Torch Handles
3. Cutting Attachments and Cutting Torches
    a. Manual
    b. Machine
        (1) Two-Hose and Three-Hose
4. Comparisons with Competition

SECTION G: TORCH TIPS AND APPLICATIONS

1. Air Fuel Tips
    a. Theory of Brazing and Welding
2. Welding Tips and Mixers
    a. Injectors
3. Welding Tip Assemblies and Separable Tips.
4. Heating Tips
5. Theory of Oxy-Fuel Cutting
6. Cutting Tips
    a. General Purpose (Straight Bore)
    b. Machine Cutting (Divergent)
7. Master Tips
8. Tip Maintenance

SECTION H: WELDING AND CUTTING OUTFITS

1. Introduction
2. Contents of Outfits
3. Reason for Outfits
4. The Airco Outfits
   a. SUPER AIRCOMASTER®
   b. AIRCOMASTER®
   c. AIRCOMITE® B
   d. AIRCOMITE®
5. Comparison with Competition

SECTION I: ACCESSORIES

1. Check Valves
2. Tip Cleaners
3. Gas Mizer
4. Guide Roller Attachment
5. Flash Circle Burner
6. Duplex Tip Holder
7. Preheat Bevel Adapter

SECTION J: PROPORTIONERS

1. Mini Proportioners
2. Large Proportioners

SECTION K: SMALL MACHINES

1. RADIAGRAPHS® 10, 16, 20
2. CAMOGRAPH®
3. Pipe Beveling Machine
4. Tensile Testing Machine

LESSON PLAN

SUBJECT: SECTION A: COMBUSTION THEORY

OBJECTIVE: To discuss the fuels presently used in oxy-fuel combustion.

REFERENCES: Product Information Class 8 Text
Section A — Combustion Theory

TRAINING MATERIALS: Product Information Class 8 Text
Section A — Combustion Theory
Slides — A-1 through A-6
Projector
Projection Screen
Oral Test

PRESENTATION:

In order to familiarize you with the oxy-fuel equipment, it is first necessary to discuss the fuels and their characteristics.

I. FUELS
Acetylene, MAPP Gas, Natural Gas, Propane and Propylene.

A. Characteristics

1. Acetylene—comes in steel cylinders under pressure at 250 p.s.i.
   a. The gas withdrawal rate in cubic feet per hour from the cylinder should not exceed 1/7 of the original contents of the cylinder.
   b. The maximum safe working pressure is 15 p.s.i.g.
   c. Acetylene specific gravity is 0.906 (Air = 1.0; therefore, acetylene is lighter than air).
2. Natural gas—comes in pipeline and at different pressures depending upon the geographic area.
   a. The specific gravity is 0.62.
3. MAPP Gas, Propane, and Propylene—come in liquid form in metal tanks under lower pressure.
   a. Purchased by weight.
   b. A 70 lb. tank has 70 lbs of liquid.
   c. The tanks are not completely filled so as to allow gas or vapor to form above the liquid.
   d. The specific gravity of these gases is about 1.48.

Slide A-1
PHYSICAL PROPERTIES OF FUELS

4. Physical Properties of Fuels.

Slide A-2
HEAT CONTENT OF FUEL

II. BRITISH THERMAL UNIT (B.T.U.)
Fuel contains energy measured in B.T.U.

Slide A-3
OPERATING RATIOS AND FLAME TEMPERATURE

III. OXYGEN RATIOS

A. To burn gas, oxygen must be mixed with it.

B. Oxygen Ratios and Flame Temperatures.

C. Oxygen in the air is also absorbed.
   1. Acetylene—quantity of oxygen supplied from the air is greater than through the torch.

Slide A-4
CHEMICAL SYMBOLS OF FUELS

IV. HEAT TRANSFER
   A. Chemical Symbols
   B. Endothermic—a reaction that absorbs heat. The formed substance upon decomposition reverses the process and releases heat—a positive (+) B.T.U. factor.
      1. Acetylene and MAPP Gas change from endothermic to exothermic when burned.
   C. Exothermic—a reaction that releases heat. The formed substance upon decomposition reverses the process and absorbs that heat—a negative (—) B.T.U. factor.
      1. Natural gas and propane change from exothermic to endothermic when burned.
   D. Primary Zone—the end has the highest temperature.

Slide A-5
COMBUSTION VELOCITIES OF FUELS

V. FLAME VELOCITY
   1. The gas flow velocity should be somewhat less than the burning velocity. The flame then remains rooted at the end of the tip and the result is a stable flame.

Slide A-6
BASIC OXY-FUEL EQUIPMENT

VI. BASIC OXY-FUEL EQUIPMENT

CONCLUSION:
SEE TEST SECTION A. COMBUSTION THEORY.

We will now have an oral test. The questions will be answered on a voluntary basis.

ORAL TEST
SECTION A. COMBUSTION THEORY

1. Name the four most commonly used fuels.

   a. b. c. d.

2. Fuel contains energy measured in

   ____ ____ [________]

3. Which fuel gas when combined with oxygen creates the highest flame temperature at the primary zone?______________________________________.

4. A reaction that absorbs heat is called endothermic. (True/False)

5. In most oxy-fuel applications the goal is to rapidly transfer the ______________ to the ________________________.

6. The gas flow velocity should be (more/less) than the burning velocity to obtain a stable flame.

ANSWERS
SECTION A. COMBUSTION THEORY

1. a. Acetylene b. Natural Gas c. Propane d. MAPP Gas
2. British Thermal Unit (B.T.U.)
3. Acetylene
4. True
5. Heat, Work
6. Less

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION A: COMBUSTION THEORY

1. Fuels

2. B.T.U.

3. Oxygen Ratio

4. Heat Transfer

5. Flame Velocity

6. Basic Oxy-fuel Equipment

OXY-FUEL COMBUSTION

In order to cover the subject efficiently, it is necessary to talk about the fuels presently used in industry.

A knowledge of the comparable characteristics of the fuels is of importance. It helps to comprehend what is taking place during the various applications of oxy-fuel combustion.

1. FUELS

The most commonly used fuels are acetylene, natural gas, propane and MAPP Gas. A new fuel, PROPYLENE, is also being actively marketed. Other fuels are also used. They are often referred to as "exotic" or manufactured fuels and consist of a base of 90 to 95% propane or propylene, with the remainder a mixture of other hydrocarbons.

a. General Characteristics

Acetylene is generally supplied compressed in cylinders at a maximum pressure of 250 p.s.i. The gas withdrawal rate in cubic-feet-per hour from the cylinder should not exceed 1/7 of the original contents of the cylinder. The maximum safe-working pressure is 15 p.s.i.g. Using air as 1 acetylene has a specific gravity of 0.906. Therefore acetylene is lighter than air.

Natural gas is supplied in pipeline and is available at pressures which vary in different geographic areas, the pipeline network and local demands. The specific gravity of natural gas is 0.62.

The other fuels Propane, MAPP Gas, Propylene and Propane Propylene base fuels are supplied in liquid form in metal tanks of various sizes. These fuels are sold by weight. For example, a certain tank will be referred to as a 50 lb. or 100 lb. tank. This means that the tank contains 50 or 100 lbs. of liquid. The tanks are not completely filled and this allows gas or vapor to form above the liquid. This vapor rises until it builds up a pressure which will not allow more liquid to vaporize. This pressure is often referred to as "equilibrium pressure". This equilibrium pressure varies with the ambient temperature and the type of fuel. The withdrawal rate of these fuels is a function of the area of liquid in contact with the wall of the cylinder and the ambient temperature. This is referred to as "wetted area". A tank with a full rated load of liquid at 70°F or 20°C will give off more vapor than a nearly empty tank at 32°F or 0°C.

Vapor pressures show on the content pressure gauge of the tank regulator and remain nearly constant. When the vapor pressure drops, it is an indication that either the tank is empty or nearly empty of liquid or the withdrawal rate is higher than the evaporation due to too low ambient temperature, insufficient "wetted area" or both.

The following table gives some of the physical properties of fuels which are useful to know in field practice.

TABLE A-1–PHYSICAL PROPERTIES OF FUELS

	Acetylene	Natural Gas	Propane	MAPP Gas	Propylene
Volume of gas per weight					
(Ft^3/lb of gas at 60°F)	14.6	23.6	8.66	8.85	8.25
(m^3/kg of gas at 15.6°C)	0.91	1.4	0.54	0.55	0.51
Specific Gravity					
(at 60°F or 16.6°C) (Air = 1)	0.906	0.62	1.52	1.48	1.48
Vapor Pressure					
(at 70°F lb/in^2)	---	---	120	94	160
(at 20°C kg/cm^2)	---	---	8.44	6.6	11.25

Volume per weight enables you to figure how much cubic feet of fuel is at hand for a given job.

2. B.T.U.—British Thermal Unit

Fuel contains energy, we generally measure it in British Thermal Unit (B.T.U.). In most theoretical situations it is referred as B.T.U. per pound (lb). In field practice it is referred as B.T.U. per cubic foot (CF). The energy or heat content or B.T.U. in the fuels presently considered is as follows:

TABLE A-2
HEAT CONTENT OF FUELS

FUEL	BTU/LB	BTU/CF
Acetylene	21500	1480
Natural Gas	23900	1000
Propane	21800	2500
MAPP Gas	21180	2406
Propylene	21100	2371

Note from the above chart that the B.T.U. per pound content of each gas is about equal. The heat content per CF, however, varies to a more noticeable degree. . .and, it is this factor, in addition to others, that largely determines the effectiveness of a fuel gas. Basically, the way in which the heat of a fuel gas is transferred to the work is the most significant factor. A brief look at this heat transfer must begin with a look at oxy-fuel ratios: the amount of oxygen needed to efficiently burn a fuel gas.

3. OXYGEN RATIOS

In order to burn, a fuel gas must be mixed with oxygen. The oxygen in the air permits the fuel gas to burn. When used with pure oxygen, the combustion is intense and the flame temperature is higher. Depending on their chemical composition, fuels need a certain proportion or ratio of oxygen to burn satisfactorily. When not enough oxygen is supplied, the flame is referred to as a carburizing flame. In this type of flame, unburned fuel escapes in the atmosphere at the end of the flame. When the proper amount for the particular fuel is reached, the flame is described as neutral. As an excess of oxygen is added, an oxidizing flame is produced.

A flame at the proper ratio can be recognized visually with a little practice.

The temperature of an oxy-fuel flame varies with the oxygen ratio and the fuel. The following table shows this effect.

TABLE A-3
OPERATING RATIOS FOR VARIOUS
FLAME TEMPERATURES

FUELS	Ratios Oxy:Fuel	Flame Temperature* ^{O}F & (^{O}C)
Acetylene	1.1:1	5600-(3090)
Natural Gas	2:1	5000-(2700)
Propane	4.5:1	5100-(2800)
MAPP Gas	2.8:1	5300-(2930)
Propylene	4.5:1	5193 (2870)

*Flame temperatures will also vary depending upon the reference used or the method of calculation.

The oxygen ratios represent the proportion of oxygen supplied through the torch. In reality a certain proportion of oxygen in the air surrounding the flame is also absorbed. In most cases it is minimal, with the exception of acetylene, where the quantity of oxygen supplied from the air is greater than the oxygen supplied through the torch. The characteristic of this type of flame is referred to as highly reducing. This is why acetylene is the most efficient in the fusion of steel. The true ratio with acetylene is 2.5 to 1. In other words, 1.4 to 1 of oxygen is supplied by the surrounding air and the other 1.1 of oxygen is supplied through the torch.

Higher temperatures can be obtained when slightly increasing the oxygen (oxidizing flame) above the appropriate neutral ratio. When the increase is too great the temperatures fall off. An oxidized flame will often damage the surface of the metal being treated as it reaches high temperatures. This is one reason why oxidized flames are seldom used.

4. HEAT TRANSFER

The chemical symbols for the fuels considered are as follows:

TABLE A-4 CHEMICAL SYMBOLS OF FUELS

Acetylene $C_2 H_2$
Natural Gas CH_4
Propane $C_3 H_8$
MAPP Gas $C_3 H_4$
Propylene $C_3 H_6$

As can be seen, these fuels consist of atoms of carbon C and hydrogen H bonded together in various numbers.

During combustion these fuels react to form different combinations of the elements. There is a generation or an absorption of heat which varies with each fuel.

A reaction that absorbs heat is called endothermic; one that releases heat is called exothermic. Upon decomposition (when burned), the process is reversed. One that absorbed heat (an endothermic substance) releases that heat; one that released heat (an exothermic substances) now absorbs that heat.

Acetylene and MAPP Gas are endothermic and natural gas and propane are exothermic. Therefore, acetylene and MAPP Gas decompose with the release of heat, a positive (+) B.T.U. factor, while natural gas and propane decompose with the absorption of heat, a negative (—) B.T.U. factor. This released heat is quite significant. The result is that acetylene and MAPP Gas are outstanding in the high heat output delivered in the primary cone.

5. FLAME VELOCITY

As can be seen, several factors are involved for the efficient use of fuels that we have covered: Heat content, heat transfer, heat distribution in the flame, and temperature. The last factor to keep in mind is flame velocity. The combustion propagation of fuels differs from each other and each one varies with the oxygen ratios.

Usually we consider the *neutral ratio* as the main point of reference.

The gas pressures which control the mixed gas flow within the equipment must be set to obtain a gas flow velocity somewhat less than the burning velocity of the gas mixtures. When this is obtained, the flames remain rooted at the end of the burning head or tip. If the gas flow is too low the flame burns in the equipment creating flashbacks or sustained burnbacks which damage the equipment. If the flow velocity is too high the flame will blow away from the tip and extinguish. When the flame remains well rooted at the end of the tip under all working conditions, it is referred as a stable flame.

Since in most oxy-fuel applications the goal is to rapidly transfer heat to the work, particularly in pre-heating, it is desirable to have a flame issuing out of the tip at the highest permissible velocity. The reason is that beside pouring out heat energy in B.T.U. at the proper coupling distance, there is also the benefit of a sort of scrubbing action. It effects an intimate contact between the hot gas and the work resulting in more efficient heat transfer.

The flame velocities of common fuels are shown in Table A-5.

TABLE A-5
COMBUSTION VELOCITIES OF FUELS

	Acetylene	Natural Gas	Propane	MAPP Gas
Ft/sec	22.7	15.2	12.2	15.4
Meter/sec	6.09	4.63	3.72	4.69

6. BASIC OXY-FUEL EQUIPMENT

To utilize oxygen and the fuel gases safely and economically in the oxy-fuel processes, it is necessary to use suitable equipment specifically designed for the purpose on the basis of years of experience.

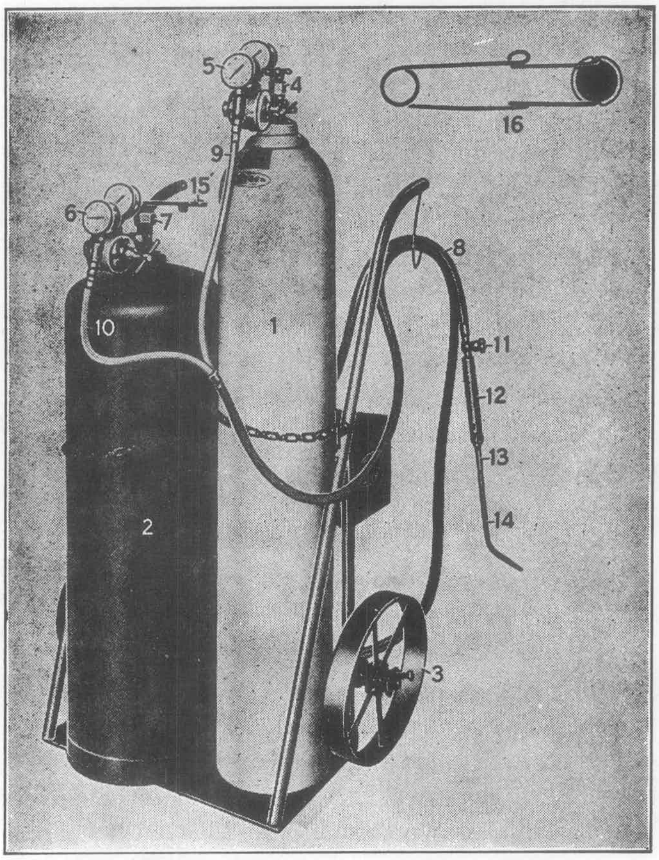
A complete oxy-acetylene welding outfit is shown in Figure A-1. Basically the apparatus consists of:

The oxygen cylinder 1 and the acetylene cylinder 2 are mounted on and chained to a cylinder truck 3. Attached to the oxygen cylinder valve 4 is the oxygen regulator 5; similarly, the acetylene regulator 6 is attached to the acetylene-cylinder valve 7. A twin, or dual, hose 8 is connected to the regulators. The twin hose is made up of two distinct gas passages, the green one 9 for oxygen being connected to the oxygen regulator and the red one 10 for acetylene to the acetylene regulator. The other ends of the twin hose are connected to the torch valves 11 which are part of the torch handle 12. (As we will discuss in another Section, check valves which prevent a reverse flow of gases from the torch back into the hose can be installed between the hose connections and the torch valves.) Into the opposite end of the torch handle is fitted the mixing head, or chamber 13, and the welding tip 14 is screwed into the mixing head.

Depending upon the particular oxy-fuel process being used, the apparatus that will most likely be changed are the mixing head, the tip and the torch. For example, in oxy-fuel cutting a cutting attachment can be used with the torch handle, and a cutting tip replaces the welding tip. Or if continuous heavy cutting is required, a specifically designed cutting torch may be substituted for the torch handle and cutting attachment.

The presentations that follow will proceed from the gases and gas supply systems, the regulators, through to the various styles and type of tips.

BASIC OXY-FUEL WELDING OUTFIT



1. oxygen cylinder
2. acetylene cylinder
3. cylinder truck
4. oxygen-cylinder valve
5. oxygen regulator
6. acetylene regulator
7. acetylene-cylinder valve
8. twin hose
9. oxygen hose
10. acetylene hose
11. torch valves
12. torch handle
13. mixing head
14. welding tip
15. wrench
16. spark lighter

Figure A-1

LESSON PLAN

SUBJECT: SECTION B: GAS SUPPLY SYSTEMS

OBJECTIVE:

1. To have the participants understand various gas supply systems and their function.
2. To stress the importance of safety measures.

REFERENCES: Product Information Class 8 Text
Section B: Gas Supply Systems

TRAINING MATERIALS: Section B: Gas Supply Systems
Slides B-1 through B-9
Projector and Screen
Supplementary Material:
Safety Booklet-ADE 872—Safe Practices in Welding and Cutting
Written Test

PRESENTATION:

I. HIGH PRESSURE GAS CYLINDERS

A. Safety measure — never take for granted that the gas contained in a cylinder is conforming to the corresponding color code. Always look at the decal located near the neck of the cylinder. This decal specifies what gas is in the cylinder.

Color code — different colors indicate different gases.

B. Compressed Gases Association

1. Safety — Cylinder valves are not alike for all gases.
2. Numbers established and standardized by CGA.

Example — CGA 540 is for oxygen.

3. Variations in CGA numbers—Airco standard established prior to CGA system still in effect.

REFER TO TABLE B-1 IN SECTION B: PAGE B-13 C.G.A. CYLINDER VALVE NUMBERS

REFER TO COLOR CHART FIGURE B-1 SECTION B: PAGE B-14.

C. Compressed Gas Cylinder Chart

1. Airco's cylinder color code
2. Type of gas
3. Dimensions
4. Maximum loading pressure
5. Content in cubic feet at 70°F.
6. CGA connection

Slide B-1
OXYGEN CYLINDER

Slide B-2
TEMPERATURE AND PRESSURE

Slide B-3
GAUGE PRESSURE, OXYGEN CONTENT

SAFETY BOOK ADE-872 SAFE PRACTICES IN WELDING

II. OXYGEN CYLINDERS

A. Oxygen is supplied in gaseous form under pressure in steel cylinders of various capacities from 20 cubic feet to 276 cubic feet at 2,200 pounds per square inch (PSI) pressure at 70°F.

B. An Airco 244 cubic foot oxygen cylinder.

C. Oxygen cylinder *pressure* changes with temperature (volume constant).

  1. At 100°F the pressure would rise to 2380 PSI.
  2. At 40°F to 2020 PSI.
  3. At room temperature the pressure returns to 2200 PSI

D. Contents

  1. As oxygen is being withdrawn from the cylinder, gauge pressure indicates oxygen contents by reference to this chart.

E. Safety—Refer to Safety Book ADE 872

  1. Keep cylinders away from oil, grease and other materials which may cause combustion.
  2. Do not use oxygen cylinders as rollers or supports.
  3. Do not strike an arc on the cylinder.
  4. Do not store near heat or flammable materials.
  5. Follow rules of the National Board of Fire Underwriters and local regulations regarding storage.

Slide B-4
ACETYLENE CYLINDER

III. ACETYLENE

A. Gas

1. Calcium carbide is used in manufacturing of acetylene.
2. Colorless
3. Pungent odor
4. Because of the release of heat energy oxygen-acetylene flame is able to produce exceedingly high temperatures.

B. Cylinders

1. Filled with highly porous mass, balsa wood, which forms a large sponge for liquid acetone, which in turn dissolves the acetylene.
2. Acetylene is supplied in five cylinder sizes. Most suppliers refer to cylinders No. 1, 2, 3, 4, or 5 cylinder or some simple designation.

   Numbers one (1) and two (2) are referred to as MC-type and B-type, respectively. They're small in size and generally are owned by the user.
3. The contents are from 10 cubic feet to 390 cubic feet, at 250 p.s.i. at 70°F.

SAFETY BOOK ADE 872
SAFE PRACTICES IN WELDING AND CUTTING

C. Acetylene Cylinder Safety—Refer to Safety Book ADE 872

   1. Must be stored in an upright position. Otherwise acetone will be discharged with acetylene when the cylinder is put into use.
   2. There is a limit to the rate of discharge. If that rate is exceeded, excessive acetone will be drawn off with the gas affecting the work.
   3. Should not be discharged at a continuous rate exceeding 50 cubic-feet-per hour from a 275 cubic-foot cylinder. Where higher discharge rates are required, several acetylene cylinders should be connected together by means of a gas manifold.
   4. Never repair a leaking cylinder.
   5. Remove a leaking cylinder to open air, away from all possible sources of ignition.
   6. Store acetylene cylinders away from oxygen cylinders.

D. Acetylene Cylinder Valve

   1. Airco acetylene cylinder valve stems are squared at the upper end for a wrench. This is a safety feature to prevent unauthorized persons from opening the cylinder.

E. Measurement of Acetylene Content

   1. Because acetylene is dissolved in acetone, the cylinder gauge pressure cannot be used as a definite measurement of the contents.

      Weigh the entire cylinder to obtain the amount of gas remaining.

      To determine the pounds of gas, subtract the tare weight from the total weight.

      Explain tare: cylinder, Balsa, Acetone.

IV. MAPP GAS AND LP GASES AND CYLINDERS

A. MAPP Gas is a mixture of methyl acetylene, propadiene, stabilized. Airco is exclusively licensed by Dow in the U.S. for distribution in metal working fields. More details are provided in the MAPP Gas "How-To" Series.

See Figure B-5
VARIOUS SIZE TANKS

B. MAPP Gas tanks are supplied in the following sizes:

1. 7½, 30, 70, and 115 lbs.

   The above refers to the weight of liquid in the tank and not the overall weight of the tank. Propane & propylene are supplied in tanks similar to MAPP Gas.

See Figure B-6, 7, 8, 9
WITHDRAWAL RATES MAPP GAS

2. The withdrawal rate of gas is a function of the ambient temperature, and the amount of liquid in the tank which is in contact with the wall (wetted area).

V. GAS MANIFOLDS

When gas is being used at a fast rate, cylinder changing becomes time-consuming.

1. Gas manifolds are used which provide a single outlet from a number of cylinders.

Slide B-5, B-6, MANIFOLDS
PORTABLE OXYGEN
PORTABLE ACETYLENE

2. There are stationary and portable manifolds.
3. They supply a pipeline or connect directly to the equipment.

Slide B-7
STATIONARY OXYGEN

4. Combined volume permits doing jobs requiring a large supply of gas and avoids interruption of work.

5. Portable manifolds are not confined to any location. Can combine 2, 3, 4, and 5 cylinders.
6. The stationary type are supported by stands and bolted to the floor or wall.

Slide B-8
SIMPLEX MANIFOLD—DOUBLE ROW

   a. Simplex—single bank of cylinders in single or double row.
      1. Interrupted gas supply when changing emptied cylinder (marked "MT")

Slide B-9
DUPLEX MANIFOLD—DOUBLE ROW

   b. Duplex—Two banks of cylinders. Provides continuous supply. As one bank is emptied the other is activated.
7. Manifolds are usually used in Plant pipe distribution systems.

VI. GAS DISTRIBUTION PIPELINE AND SAFETY

A. American National Standard Institute (ANSI) pamphlet Z49.1 contains the regulations of these gas distribution systems; also NFPA 51.4.
and OSHA.

SEE APPROPRIATE PAGES IN SECTION B FOR EXCERPTS FROM OSHA, SUB PART Q. WELDING, CUTTING, BRAZING

   1. Service Piping Systems
   2. Protective equipment, hose and regulators.

B. Installation Requirements.
   1. In a fuel pipeline distribution system, fuel gases available under pressure can be used interchangeably with the exception of natural gas when it is under 10-15 p.s.i.

SEE FIGURE B-16, FIGURE B-17. AND TABLE B-7 IN SECTION B ON CONVERTING OTHER FUELS AND INSTALLATION REQUIREMENTS

TURN TO SECTION B: TEXT MATERIAL WHERE THE PIPELINE ACCESSORIES ARE PICTURED.

CONCLUSION:

This exception is due to the low B.T.U. content of natural gas which requires higher flow rates than other fuels to perform a given work.

2. If the overall natural gas flow rate requirement in the plant is not large and only low pressure natural gas is available, the existing pipeline system must include a booster pump shown on Figure B-16 or the existing pipeline must be modified, as shown in Figure B-17 and Table B-7.

VII. PIPELINE ACCESSORIES

A. Whenever making pipeline modification or installation, refer to pipeline accessories for hydraulic flashback arrester, non-return station valves, non-return check valve, station outlet, flow control valves and bursting disc.

We will now have a written test as a review of the material discussed in SECTION B: GAS SUPPLY SYSTEMS.

WRITTEN TEST
SECTION B: GAS SUPPLY SYSTEMS

DIRECTIONS: Answer all questions and grade your own paper. Grade yourself satisfactory or unsatisfactory. We are striving for complete (100%) understanding of all material; therefore, if you have any difficulty getting the answer, review the material and check your answers on the next page.

1. The color code is one way to determine the gas contained in a cylinder. What is the other method? ______________________.

2. CGA means (________________ ________________ ________________).

3. Is the pressure the same in an oxygen cylinder regardless of size? Yes/No.

4. What would change the pressure in an oxygen cylinder? ________________.

5. As oxygen is being withdrawn from the cylinder, the contents remaining can be determined by the ________________ ________________.

6. The agency that establishes rules for the safe storage of cylinders is called ______________ __________ of ________ ____________________.

7. In an acetylene cylinder, acetylene is absorbed by ________________.

8. The acetylene cylinder content should not be discharged at a continuous rate exceeding 50 cubic feet per hour from a 275 cubic feet per hour cylinder. True/False

9. Acetylene cylinder valves have a knob that can be turned by hand. True/False

10. The purpose of manifold is to provide a large ________________ of gas from a number of cylinders.

11. There are two types of manifolds: one is stationary, the other ___________.

12. There are two types of modular manifolds in the stationary system:
    1. ____________________________ 2. ____________________________.

SECTION B. GAS SUPPLY SYSTEMS

ANSWERS

1. Decal
2. Compressed Gas Association
3. Yes
4. Temperature
5. Gauge Pressure
6. National Board of Fire Underwriters
7. Acetone
8. True
9. False
10. Volume or Amount
11. Portable
12. Simplex, Duplex

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION B
GAS SUPPLY SYSTEMS

1. High Pressure Gas Cylinders
    a. Color Code of Cylinders.
    b. Compressed Gas Association Standards
2. Oxygen and Oxygen Cylinders
3. Acetylene and Acetylene Cylinders
4. MAPP Gas, L.P. Gases and Tanks
    a. Withdrawal Rates
5. Gas Manifolds and Manifolding of Cylinders
6. Gas Distribution Systems and Safety Standards
7. Pipeline Accessories

1. HIGH PRESSURE GAS CYLINDERS

COLOR CODE

Many of Airco's industrial gases are delivered to the users in high pressure gas cylinders on a rental basis. At first glance a layman may think that they all look pretty much alike. It can readily be seen (Fig. B-1) that they are painted in various colors. These colors represent a code. With the considerable handling of these cylinders, they are submitted to shocks and scratches, with the oxidation on the surface of the cylinder and the fading of the paint, the color code is not always obvious. NEVER TAKE FOR GRANTED THAT THE GAS CONTAINED IN A CYLINDER IS CONFORMING TO THE CORRESPONDING COLOR CODE. ALWAYS LOOK AT THE DECAL LOCATED NEAR THE NECK OF THE CYLINDER. THIS DECAL SPECIFIES THE GAS IN THE CYLINDER.

CGA STANDARDS (Table B-1)

Cylinder valves control the flow of gas from the cylinder. For safety, cylinder valves are not alike for all the gases. The differences mainly involve the configuration of the outlet orifices and the connection thread sizes. They have been established and standardized by the Compressed Gas Association. A connection for a specific type of cylinder is always referred by a CGA number for example — CGA 540 is for oxygen.

VARIATIONS IN CGA NUMBERS

Airco cylinder valve standards were established long before the CGA valve standards. With the large number of cylinders in service, an immediately enforced standardization of all the valves would have been costly.

TABLE B-1

COMPRESSED GAS CYLINDER VALVE OUTLET CONNECTIONS

	Present Airco Standard		**CGA Standard Connections**		
	CGA Conn. No.	**Valve Outlet**		**CGA Conn. No.**	**Valve Outlet**
Oxygen	540	0.903"—14 NGO—RH—Ext	Oxygen	540	0.903"—14 NGO—RH—Ext
Water Pumped Nitrogen	580	0.965"—14 NGO—RH—Int	Water Pumped Nitrogen	580	0.965"—14 NGO—RH—Int
Nitrogen, OP	550	0.903"—14 NGO—LH—Ext	Nitrogen, OP	590	0.965"—14 NGO—LH—Int
Argon*	540	0.903"—14 NGO—RH—Ext	Argon	580	0.965"—14 NGO—RH—Int
Hydrogen	350	0.825"—14 NGO—LH—Ext	Hydrogen	350	0.825"—14 NGO—LH—Ext
Helium	350	0.825"—14 NGO—LH—Ext	Helium	590	0.965"—14 NGO—LH—Int
Acetylene*	300	0.825"—14 NGO—RH—Ext	Acetylene	510	0.885"—14 NGO—LH—Int
Carbon Dioxide	320	0.825"—14 NGO—RH—Ext	Carbon Dioxide	320	0.825"—14 NGO—RH—Ext

*NOTE: Airco Standard Cylinder Valve Outlets are being converted to CGA Standards in certain instances. Where deviations occur between Airco and CGA Standards, consult the nearest Airco Regional Office for information concerning the standard employed in a specific area.

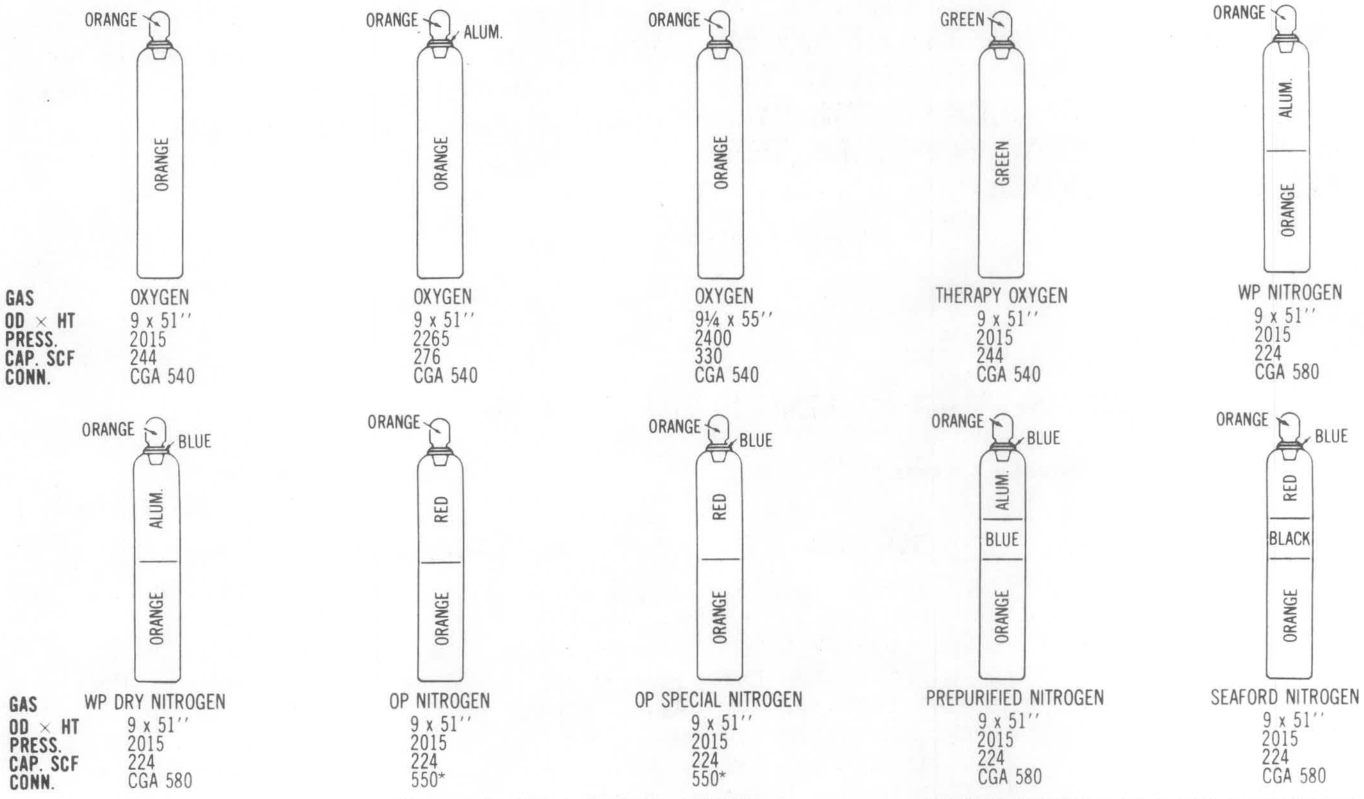
NGO (National Gas Outlet) is the American Standard designation for outlet threads on the valves of compressed gas cylinders.

As new cylinders come into service, the present CGA system is applied; however, a substantial number of cylinders are in service with valve outlets that do not conform to CGA standard. Table B-1 shows differences between the Airco standard still in effect that one will undoubtedly come across and the present CGA standard.

The following chart which shows 50 various cylinders indicates:

1. The color of the cylinder.
2. The type of gas.
3. Its dimension in inches.
4. Its maximum loading pressure.
5. Its content in cubic feet at 70°F.
6. Its CGA connection.

The regulator that will be used with any of these cylinders must have the corresponding CGA connection. A regulator inlet connection nut should never be "forced" onto a cylinder valve connection. If force is necessary, it is an indication that the incorrect cylinder or regulator is being used.



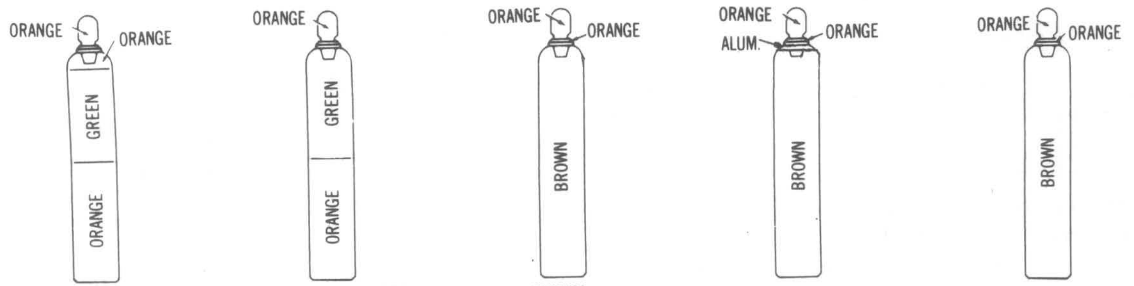
GAS	OXYGEN	OXYGEN	OXYGEN	THERAPY OXYGEN	WP NITROGEN
OD × HT	9 x 51″	9 x 51″	9¼ x 55″	9 x 51″	9 x 51″
PRESS.	2015	2265	2400	2015	2015
CAP. SCF	244	276	330	244	224
CONN.	CGA 540	CGA 540	CGA 540	CGA 540	CGA 580

GAS	WP DRY NITROGEN	OP NITROGEN	OP SPECIAL NITROGEN	PREPURIFIED NITROGEN	SEAFORD NITROGEN
OD × HT	9 x 51″	9 x 51″	9 x 51″	9 x 51″	9 x 51″
PRESS.	2015	2015	2015	2015	2015
CAP. SCF	224	224	224	224	224
CONN.	CGA 580	550*	550*	CGA 580	CGA 580

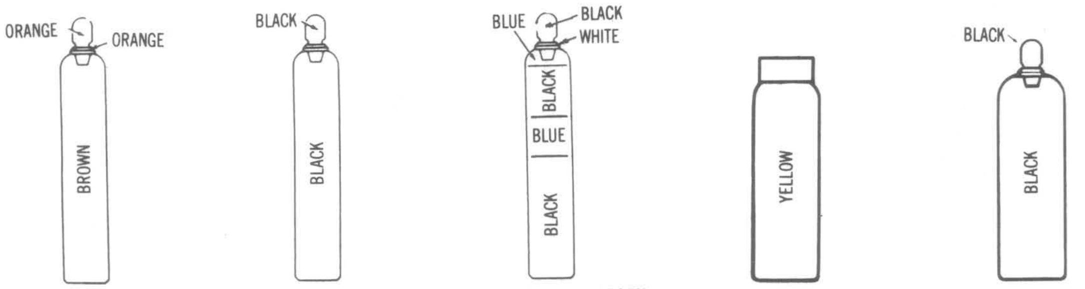
*Valve connection 550 is Airco designation for CGA 555.

CAUTION: IDENTIFY CYLINDER CONTENT BY LEGIBLE SHOULDER DECAL ONLY

Figure B-1

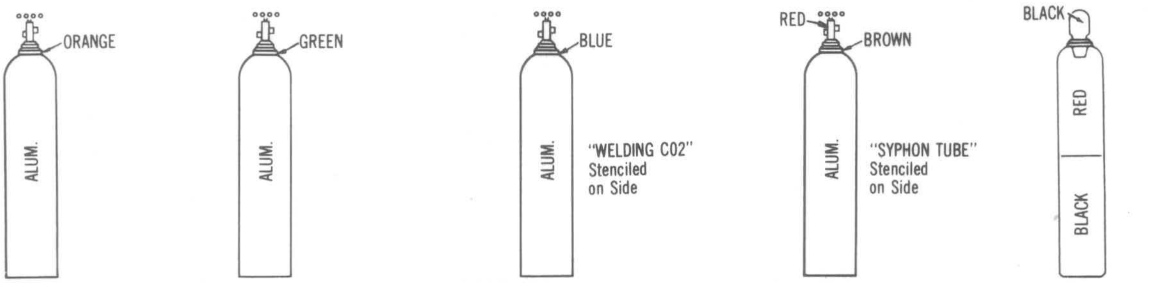


GAS	ARGON	LAMP GRADE ARGON	HELIUM	HELIUM	HELIUM
OD × HT	9¼ x 55″	9 x 51″	9 x 51″	9 x 51″	9 x 51″
PRESS.	2400	2015	1800	2015	2265
CAP. SCF	330	119 to 238	194	213	242
CONN.	CGA 580	CGA 580	CGA 580	CGA 580	CGA 580

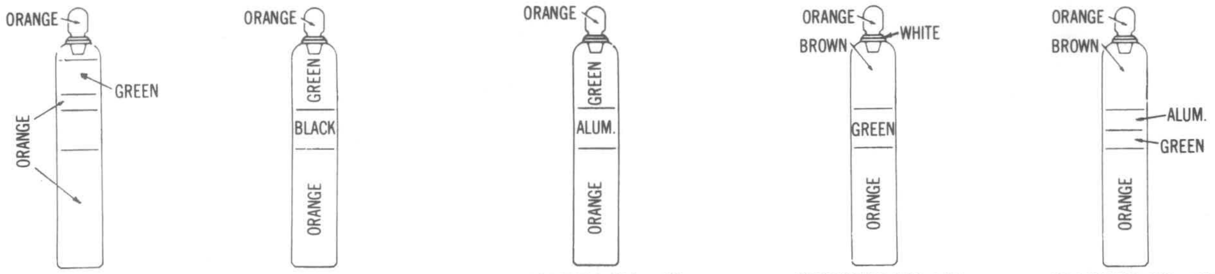


GAS	HELIUM	HYDROGEN	PREPURIFIED HYDROGEN	MAPP GAS	ACETYLENE
OD × HT	9¼ x 55″	9 x 51″	9 x 51″	3 x 11″ to 30 x 54″	4 x 10″ to 12 x 36″
PRESS.	2400	1800 & 2015	1800 & 2015	240	8 & 8AL
CAP. SCF	285	176 or 191 & 194 or 210	176 or 191 & 194 or 210	1 lb. to 480 lbs.	10 to 360
CONN.	CGA 580	CGA 350	CGA 350	CGA 510	CGA 300 & 510

CAUTION: IDENTIFY CYLINDER CONTENT BY LEGIBLE SHOULDER DECAL ONLY



GAS	CARBON DIOXIDE (Beverage)	CARBON DIOXIDE (Industrial)	CARBON DIOXIDE (Welding)	CARBON DIOXIDE (Syphon Tube)	FORMING GAS
OD × HT	8½ x 21″ & 8½ x 51″	8½ x 21″ & 8½ x 51″	8½ x 21″ & 8½ x 51″	8½ x 21″ & 8½ x 51″	9 x 51″
PRESS.	1800 & 1800	1800 & 1800	1800 & 1800	1800 & 1800	2015
CAP. SCF	20 lbs. & 50 lbs.	20 lbs. & 50 lbs.	20 lbs. & 50 lbs.	20 lbs. & 50 lbs.	204 to 227
CONN.	CGA 320	CGA 320	CGA 320	CGA 320	CGA 350



GAS	AIRCOMATIC GAS #1,2&5	AIRCOMATIC GAS #15 and PA-35	AIRCOMATIC GAS #25	AIRCOMATIC GAS #75	AIRCOMATIC GAS #90
OD × HT	9¼ x 55″	9¼ x 55″	9¼ x 55″	9¼ x 55″	9¼ x 55″
PRESS.	2400	2400	2400	2400	2400
CAP. SCF	330	293	375	296	285
CONN.	CGA 580	CGA 580	CGA 580	CGA 580	CGA 580

CAUTION: IDENTIFY CYLINDER CONTENT BY LEGIBLE SHOULDER DECAL ONLY

Figure B-1 Continued

SPECIALTY GASES SHIPPED FROM RIVERTON, N. J.

1. Cylinder information shown is for Specialty Gases shipped from Riverton in steel cylinders of various sizes and D.O.T. service pressures of 2015 and 2265 psig, except as noted.

   Capacities depend on product and D.O.T. service pressure.

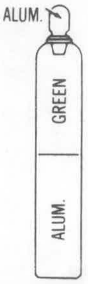
2. Aluminum cylinders for shipping Specialty Gases are of various sizes and D.O.T. service pressures of 2016 and 2216 psig.

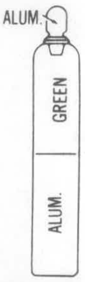
   Capacities depend on product and D.O.T. service pressure.

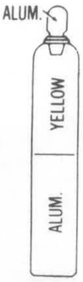
   CGA valve connections depend on product.

   No color code is applied except shoulders are painted gray for Carbon Monoxide and for mixtures containing Carbon Monoxide.

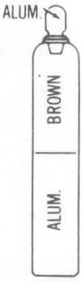
   Contents are stenciled on side of cylinder.

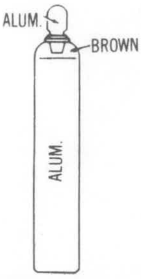


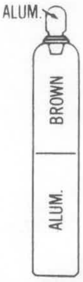


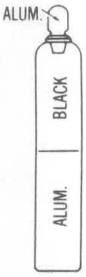


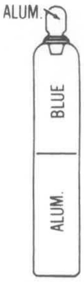
GAS	ARGON	6000 PSIG ARGON	XENON
OD × HT		10 x 51''	
PRESS.		6000	
CONN.	CGA 580	CGA 677	CGA 580





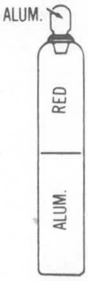


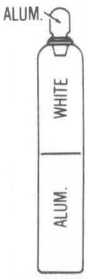


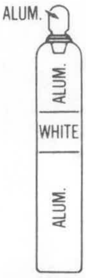


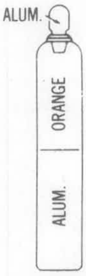
GAS	HELIUM	GRADE 6 HELIUM	6000 PSIG HELIUM	HYDROGEN	KRYPTON
OD × HT			10 x 51''		
PRESS.			6000		
CONN.	CGA 580	CGA 580	CGA 677	CGA 350	CGA 580

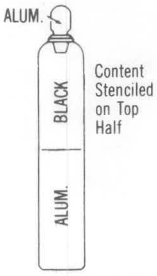
CAUTION: IDENTIFY CYLINDER CONTENT BY LEGIBLE SHOULDER DECAL ONLY



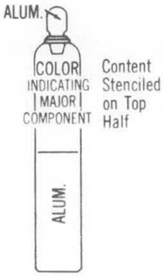


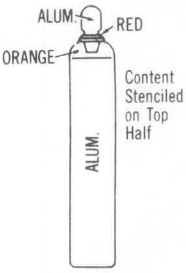


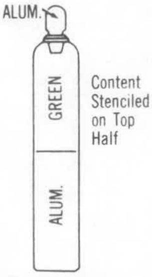


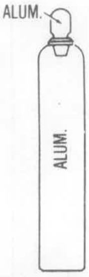


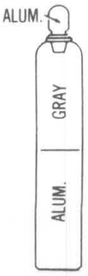
GAS	NEON	NITROGEN	6000 PSIG NITROGEN	OXYGEN	TYPICAL DOPING GAS MIXTURE IN HYDROGEN
OD × HT			10 x 51''		
PRESS.			6000		
CONN.	CGA 580	CGA 580	CGA 677	CGA 540	CGA 350


ALUM.
COLOR INDICATING MAJOR COMPONENT
Content Stenciled on Top Half
ALUM.









GAS	CUSTOM MIXTURES	SYNTHETIC AIRS	TYPICAL MIXTURE Argon Plus One or Two Minor Gases	TYPICAL HYDROCARBONS (Except Methane)	METHANE
CONN.	CGA depends on mixture	CGA 590	CGA depends on mixture	CGA 350	CGA 350

CAUTION: IDENTIFY CYLINDER CONTENT BY LEGIBLE SHOULDER DECAL ONLY

Figure B-1 Continued

2. OXYGEN AND OXYGEN CYLINDER

Oxygen is the life and fire sustaining element in the air. It is also the most widely distributed and commonest of all the elements (See Table B-2). About 21% by volume of air and about 89% by weight of water is made up of oxygen. In the form of various oxides, it comprises a considerable portion of the earth's rocks and soil.

TABLE B-2

ANALYSIS OF ATMOSPHERIC AIR

Gas	Per Cent, by Volume
Nitrogen	78.03
Oxygen	20.99
Argon	0.94
Carbon Dioxide	0.034
Hydrogen	0.01
Neon	0.0066
Helium	0.0002
Krypton	0.00001
Xenon	0.0000011

PROPERTIES: Oxygen at ordinary temperatures is a colorless, tasteless and odorless gas. It is 1.1056 times as heavy as air, and at atmospheric pressure and 70°F. 12.07 cubic feet of oxygen weighs one pound and one cubic foot weighs 0.08283 pounds.

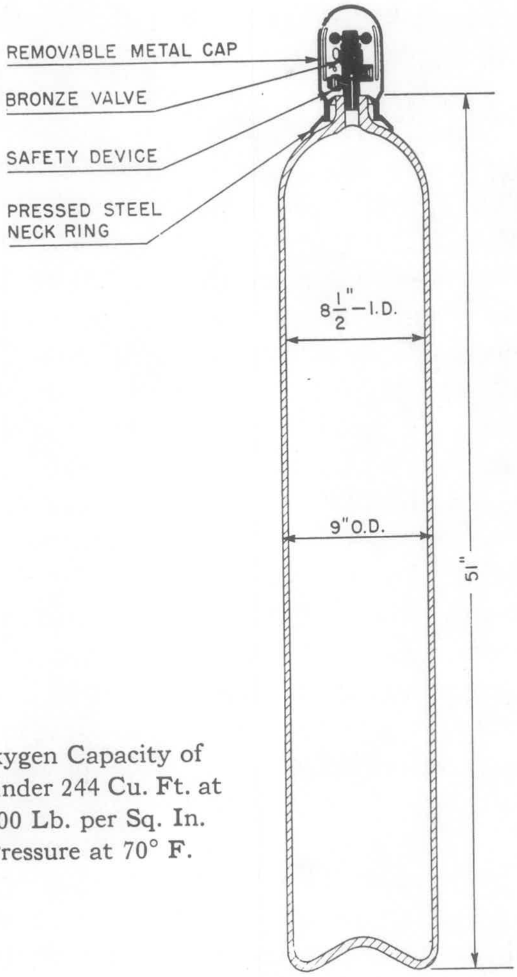
Oxygen forms oxides by direct combustion with many other elements. It is non-flammable but it intensely activates the combustion of flammable elements or material, once they are ignited. Oxygen should always be referred to by its correct name "oxygen", and not by the word "air". This will help to prevent the disaster of substituting oxygen for compressed air.

FUNCTION IN COMBUSTION: Oxygen is "consumed" in fire, that is, it enters into various chemical combinations with the combustible elements in the fuel. Oxygen is necessary for combustion. Shut off the oxygen supply and a fire quickly dies. Blow into a fire and it burns more brightly because more oxygen is forced through the fuel. The purer the oxygen the hotter the fire, because the heat loss to the waste gases is smaller. All substances which burn in air, burn with much greater brilliancy in pure oxygen, and many that cannot be burned in air at all can be burned quite easily in oxygen. Thus, an iron wire, if previously heated to the ignition temperature—about 1600°F.—burns with dazzling brilliancy in oxygen.

OXYGEN IN CYLINDERS: Commercial oxygen is generally supplied to users at 99.5% purity in seamless steel cylinders (Fig. B-2). These cylinders hold 244 cubic feet of oxygen at a pressure of 2200 psi (pounds per square inch) at 70°F. The outside diameter of a standard cylinder is about 9 inches and the height from base to top of cap is about 54 inches. The weight of a cylinder complete with valve and cap ranges from 104 pounds to 139 pounds, depending upon the type of steel used. The gas charge at the standard pressure of 2200 psi at 70°F. will increase this weight by approximately 20 pounds. A smaller commercial oxygen cylinder containing 122 cubic feet at 2200 psi and 70°F. is also furnished for the convenience of users requiring small volumes or for use on outside jobs, to make handling easier.

The pressure of oxygen in a cylinder varies with temperature according to a definite physical law. But the weight and oxygen content remain unchanged unless oxygen is withdrawn from the cylinder. Thus, a fully loaded oxygen cylinder brought into a shop from outside, where the temperature is zero, will show a pressure reading of only 1780 psi when the pressure regulator is first attached. However, when the cylinder and contents warm up to room temperature the pressure reading keeps rising until it reaches about 2200 psi at 70°F. This variation of pressure with temperature is shown in Table B-3 that follows.

On some gauges the approximate volume remaining in a used oxygen cylinder can be read on the inner graduated circle of the pressure regulator gauge. Table B-4 that follows give the approximate volume content of a 244 cubic foot Airco cylinder as indicated by gauge pressure.



Oxygen Capacity of Cylinder 244 Cu. Ft. at 2200 Lb. per Sq. In. Pressure at 70° F.

Figure B-2

VARIATIONS IN OXYGEN CYLINDER PRESSURES WITH TEMPERATURE CHANGES

Gauge pressures indicated for varying temperature conditions on a full cylinder initially charged to 2200 p.s.i. at 70°F. Values identical for 244 cu. ft. and 122 cu. ft. cylinder.

TABLE B-3

Temperature Degrees F.	Pressure psi approx.	Temperature Degrees F.	Pressure psi approx.
120	2500	30	1960
100	2380	20	1900
80	2260	10	1840
70	2200	0	1780
60	2140	—10	1720
50	2080	—20	1660
40	2020		

TABLE B-4
OXYGEN CYLINDER CONTENT

Indicated by Gauge Pressure at 70°F. 244 Cu. Ft. Cylinder

Gauge Pressure psi	Content Cu. Ft.	Gauge Pressure psi	Content Cu. Ft.
190	20	1200	130
285	30	1285	140
380	40	1375	150
475	50	1465	160
565	60	1550	170
655	70	1640	180
745	80	1730	190
840	90	1820	200
930	100	1910	210
1020	110	2000	220
1110	120	2090	230
		2200	244

122-cu. ft. cylinder content one-half above volumes.

OXYGEN CYLINDER SAFETY: Oxygen cylinders, (in addition to other transport containers charged with a compressed gas as defined by law) are subject to the Interstate Commerce Commission Rules governing such containers.

For a complete guide to oxygen cylinder safety, see Airco publication ADE 872.

Oxygen cylinders are checked from time to time and any cylinder that is badly dented or corroded must be taken out of service. Oxygen cylinders are also initially tested at 5/3 the service pressure by the manufacturer and then periodically checked at the same pressure by the oxygen producer.

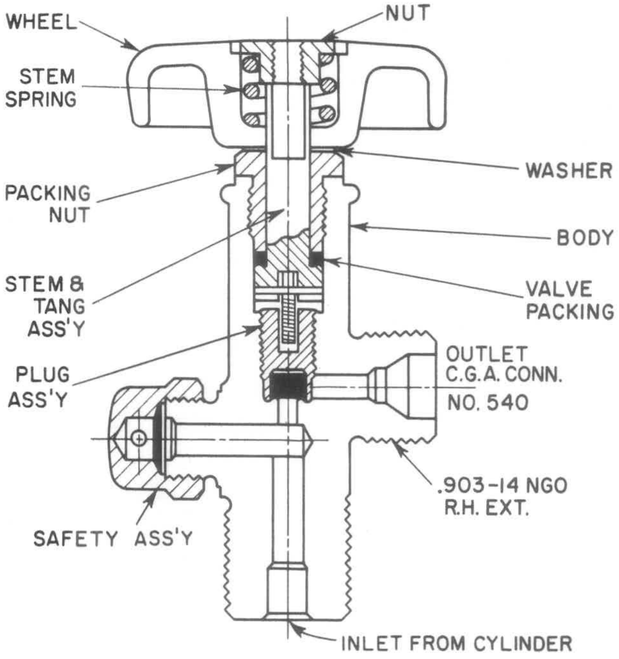


Figure B-3
CUT-AWAY DRAWING OF AIRCO OXYGEN CYLINDER VALVE

Oxygen cylinders are supplied with a specially designed bronze valve with a hand wheel (see Fig. B-3). The valve should be tightly closed and protected by a valve cap when the cylinder is shipped, whether filled or empty. The valve stem is connected to the lower part of the valve by a tang. This tang is sufficiently strong to operate the valve for normal opening or closing, but it may break if undue pressure is applied in closing the valve, such as using a wrench or additional leverage.

Care should be taken in storing and handling oxygen cylinders. They should not be stored near heat or highly flammable materials. Follow the National Board of Fire Underwriters rules and local regulations in regard to cylinder storage.

Oil, grease and other easily oxidizable materials must be kept away from oxygen cylinders and valves, and also away from any other oxygen apparatus, because of the danger of combustion. A small drop of grease inside an oxygen valve can initiate a fire and cause an explosion.

Oxygen cylinders are intended solely for use in storing oxygen. They should never be used as rollers or supports. They should not be used to handle any other gas. Another practice to avoid is striking an arc on the cylinder. This is an extremely dangerous practice, since the cylinder may rupture and injure the operator.

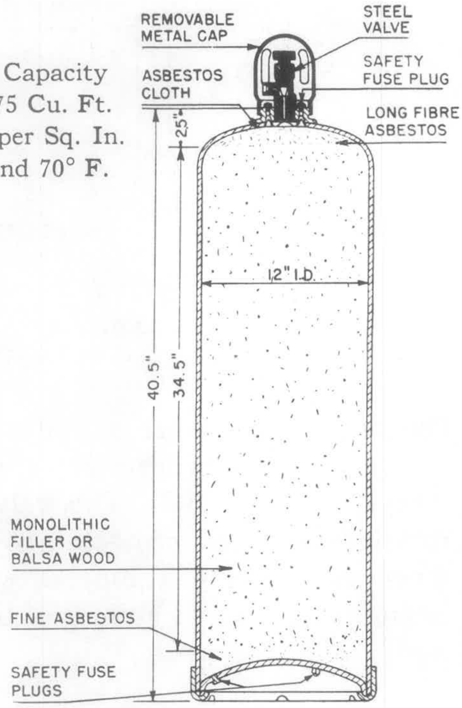
3. ACETYLENE AND ACETYLENE CYLINDERS

PROPERTIES: Acetylene is a colorless gas at normal temperatures, and it is made up of molecules containing two atoms of carbon and two atoms of hydrogen. When commercially pure it is readily distinguishable by its characteristic pungent odor. When under pressure or when liquefied it can be dissociated by heat or shock, causing a potentially uncontrolled release of energy.

It is the controlled releasing of heat, due to dissociation of its component parts that makes acetylene useful. Like any other hydrocarbon, acetylene produces considerable heat when burned due to the heat of formation of the oxides of carbon and hydrogen. However, acetylene also produces heat because of the aforementioned dissociation. This heat of dissociation is energy that was originally stored in the calcium carbide when it was manufactured and then passed on when the acetylene was formed. Because of this large release of heat energy, the oxyacetylene flame is able to produce exceedingly high temperatures, which far surpass those produced by other commercially available gas flames.

Acetylene is very easily ignited, releasing its tremendous heat energy. Because it is so highly flammable it always should be referred to by its correct name "acetylene", and not by the word "gas". This makes sure that it is not mistaken for common city or furnace gas.

CONSTRUCTION OF ACETYLENE CYLINDERS: The Airco acetylene cylinder is made of steel. It is filled with a highly porous mass, filler which forms a large sponge for liquid acetone. Acetone is an organic liquid used to dissolve the acetylene. The porous filler is charged with acetone up to 36.2 per cent of its volumetric capacity. This affords space for expansion, since acetone increases considerably in bulk as it absorbs acetylene. The cylinders are provided with fusible safety plugs in the bottom and in the top of the cylinder. The purpose of the plugs is to melt and release the gas if the temperature exceeds 220°F., and thus prevent explosions. (See Fig. B-4).



Acetylene Capacity
Approx. 275 Cu. Ft.
at 250 Lb. per Sq. In.
Pressure and 70° F.

Figure B-4

CARE AND SAFETY OF ACETYLENE CYLINDERS: Acetylene cylinders should be stored and handled with care. They were designed for one purpose only, and should not be used as rollers, props, etc., nor should any other gas be stored in them.

Care should be taken to keep the acetylene cylinders away from all source of heat and sparks. Also, they should be stored well away from oxygen cylinders.

Acetylene cylinders must be kept in an upright position. If they are stored on their sides or upside down the acetone is likely to be discharged along with the gas when the cylinder is put into use, unless it is first allowed to stand upright for some time.

Also, while Airco cylinders will discharge acetylene very rapidly, there is a limit to the rate of desirable discharge. If that rate is exceeded excessive acetone will be drawn off with the gas, affecting the work. The cylinder content should not be used at a continuous rate exceeding 50 cubic feet per hour from a 275 cubic foot cylinder. Where higher discharge rates are required, acetylene cylinders must be manifolded.

If an acetylene cylinder is damaged and is leaking, it should be removed to the open air, away from all possible sources of ignition, and the manufacturer should be notified immediately, giving the cylinder number stamped on the side. UNDER NO CIRCUMSTANCES SHOULD ANY ATTEMPT BE MADE TO REPAIR A LEAKING CYLINDER BY WELDING OR BY ANY OTHER MEANS.

ACETYLENE CYLINDER VALVE: Airco acetylene cylinder valve stems are squared at the upper end for a wrench. This type of valve handle will prevent unauthorized persons from opening the cylinder, releasing the gas which could cause a fire.

The outlet of the valve is threaded for connection to an acetylene pressure regulator using the inlet nut on the regulator. The regulator inlet connection gland seats against the face of the threaded cylinder connection, and the inlet connection nut draws the two surfaces together. Sometimes the threaded connection will be damaged by misuse and the seating face marred, making it difficult to connect the regulator. In such cases, no attempt should be made to use the gas, and the defective valve should be reported to the gas manufacturer, giving the number which is stamped on the side of the cylinder.

MEASUREMENT OF ACETYLENE IN CYLINDERS: Because the acetylene is dissolved in acetone, the cylinder gauge pressure cannot be used as a definite measurement of the volume of acetylene in a cylinder. Therefore, it is necessary to weigh the entire cylinder to obtain the amount of gas remaining. By subtracting the tare weight of cylinder from the total weight, the pounds of gas may be determined. By multiplying the pounds of acetylene by the cubic feet per pound (about 14.74 at 70°F.) the volume of acetylene is obtained. Thus, a cylinder having a tare weight of 181 pounds when empty and 200 pounds when full contains 19 pounds of acetylene, or 280 cubic feet.

CYLINDER RETURNS: When returning cylinders the valve should be tightly closed and the cap, where provided, screwed on the valve collar. The cylinders should be plainly marked MT (for "empty"), and a tag should be attached giving the customer's name and address. While awaiting shipment, empties should be stored away from full cylinders to avoid dangerous confusion.

CURRENT AIRCO ACETYLENE CYLINDERS:

#3 — 60-75 or 80 CF

#4 — 125 CF

#5 — 275 CF the newer #5 cylinders contain 390 CF

(Number 1 size is called the MC-type and number 2, the B-type. They are small in size and generally are owned by the user.)

All the above cylinders have commercial fitting, CGA 300. Smaller cylinders used mostly in heating and refrigeration service trade are referred to as: "B" cylinders. They contain 40 CF of acetylene and the connection is a CGA 520. Also the "MC" cylinders contain 10 CF with a CGA 200 connection (The MC denomination comes from "Motor Car Cylinders".)

Competitive Acetylene Cylinders similar to size #3, #4 and #5 have a CGA 510 valve fitting.

4. MAPP® GAS, LP GASES AND TANKS

MAPP® Gas — short for methylacetylene propadiene. It is a mixture of stabilized methylacetylene and propadiene (C_3H_4). It's a high-energy fuel.

Liquid petroleum gases such as propane, propylene and many other manufactured gases have somewhat similar physical properties and are stored in the same type of tanks as MAPP Gas (Fig. B-5). Due to their great variety in sizes we will not list them. They are all fitted with CGA 10 valve outlets. Table B-5 lists the seven specifications for commonly used MAPP Gas tanks.

SPECIFICATIONS

TABLE B-5

MAPP GAS TANKS

MODEL NO.	PART NUMBER	TYPE	MAPP GAS CAP. LBS.	DIAMETER	OVERALL HEIGHT	TARE WEIGHT	GROSS WEIGHT	WATER CAPACITY
MPD-CY-7.5**	0145-0075	Collar	7.5	6"	22"	7.5*	15	15
MPD-CY-30	0145-0300	Collar	30	9"	35"	25.5	55.5	61
MPD-CYRC-30	0145-0301	Cap	30	9"	35"	25.5	55.5	61
MPD-CY-70	0145-0700	Collar	70	12"	44"	55	125	143
MPD-CYRC-70	0145-0701	Cap	70	12"	44"	56	126	143
MPD-CY-115	0145-1150	Collar	115	14-3/4"	47-1/2"	69	184	239
MPD-CYRC-115	0145-1151	Cap	115	14-3/4"	48-1/2"	72	187	239

*Tare Weight Includes Valve (and cap — if cap type). These weights are average as cylinders will vary in weight.

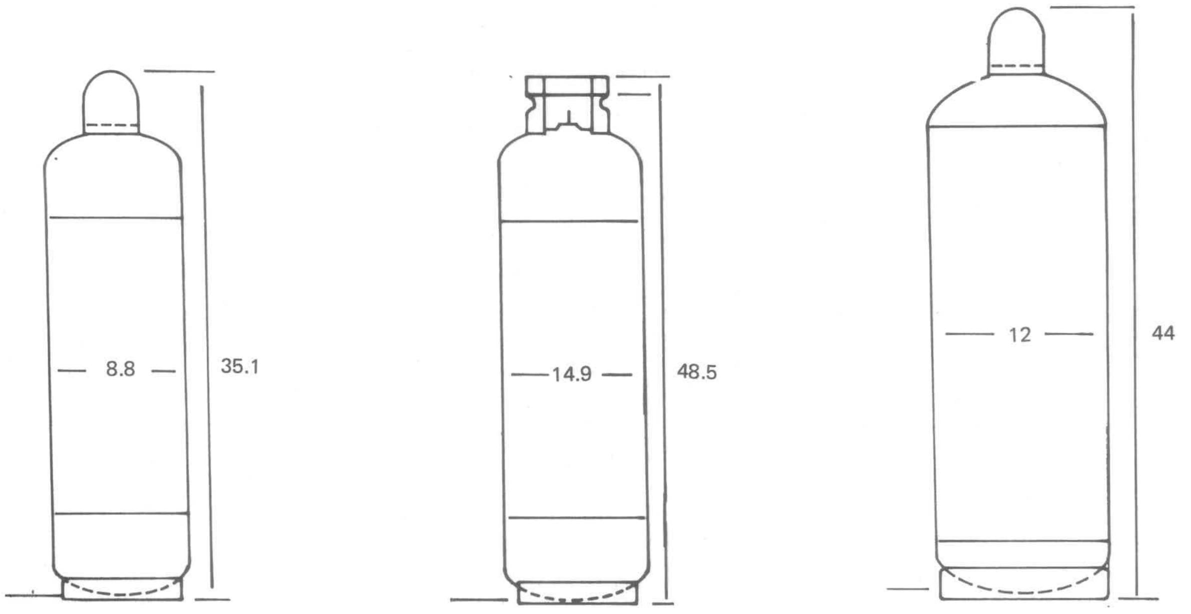
** MPD-CY-7.5 is Aluminum — All other cylinders are steel.

STEEL CYLINDERS GENERAL SPECIFICATIONS:

- All Welded Construction
- Manufactured in Accordance with ICC4BW240 and ICC4BA240 Under Special Permit Number 3451
- Painted Standard Yellow Color in Accordance with Airco Specification
- Personalized Markings if Specified on Orders of 25 or More
- Complete with Approved Valve
- RC Cylinder include Cap
- Guard Ring with Curled Hand Holes on Collar Models
- ICC Stamping

ALUMINUM CYLINDER GENERAL SPECIFICATIONS:

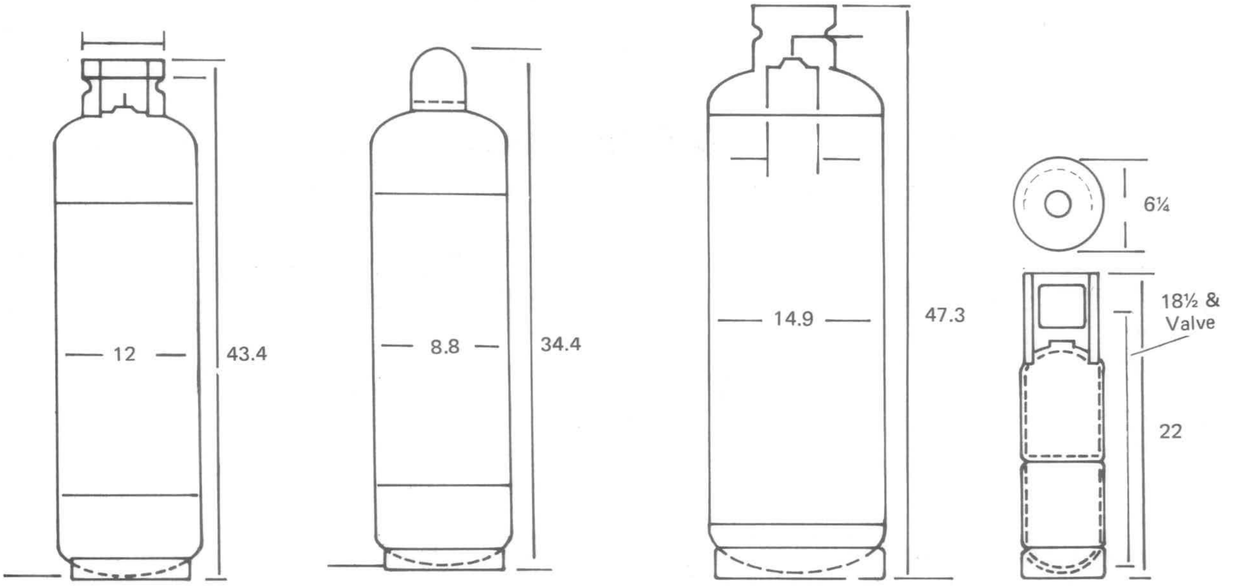
- All Welded Construction
- Manufactured in Accordance with ICC4E300
- Complete with Approved Valve
- Guard Ring with Hand Holes



MPD-CYRC-30 MAPP GAS STEEL CYLINDER
With Valve and Removable Cap
30 Pound Capacity

MPD-CY-30 MAPP STEEL CYLINDER
With Valve and Permanent Collar
30 Pound Capacity

MPD-CYRC-70 MAPP STEEL CYLINDER
With Valve and Removable Cap
70 Pound Capacity



MPD-CY-70 MAPP STEEL CYLINDER
With Valve and Permanent Collar
70 Pound Capacity

MPD-CYRC-115 MAPP STEEL CYLINDER
With Valve and Removable Cap
115 Pound Capacity

MPD-CY-115 MAPP STEEL CYLINDER
With Valve and Permanent Collar
115 Pound Capacity

MPD-CY-7.5 ALUMINUM CYLINDER
With Valve and Permanent Collar
7.5 Pound Capacity

Figure B-5

WITHDRAWAL RATES: As with all LPG tanks the withdrawal rate of gas is a function of the ambient (surrounding air) temperature and also the amount of liquid in the cylinder which is in contact with the wall of the cylinder. This is generally referred to as the "wetted area" or the amount of internal surface of the cylinder in contact with the liquid. In the following graphs the wetted area is represented by the "% of full." (Figures B-6 through B-9 provide data on withdrawal rates of MAPP Gas from various cylinder sizes.)

MAPP® Gas

CONTINUOUS WITHDRAWAL RATES FROM A 7½ LB. CYLINDER

AMBIENT TEMP.
5 MPH AIR VELOCITY
15 PSIG (FOR 28 PSIG ADD 20°F)

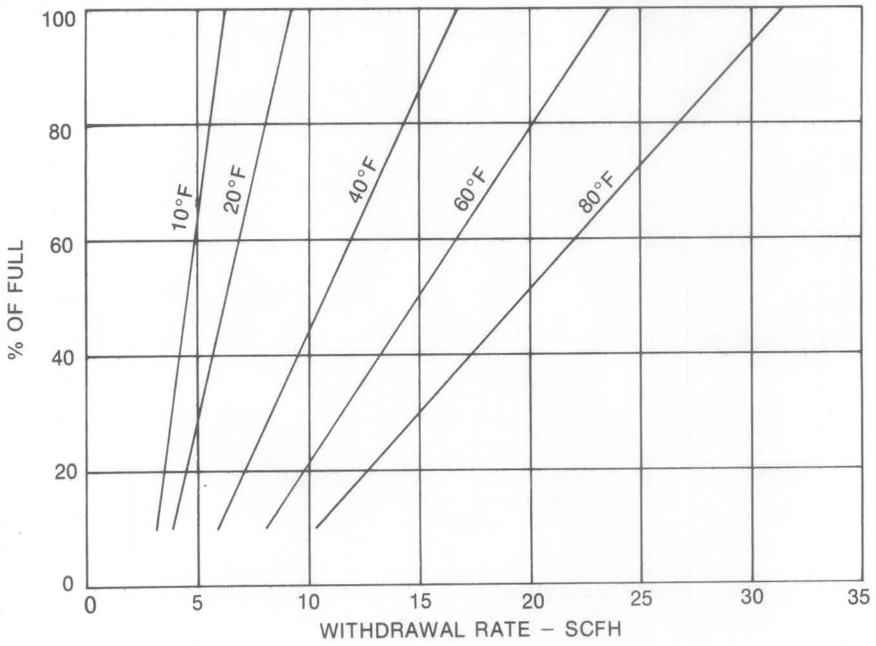


Figure B-6

MAPP® Gas

CONTINUOUS WITHDRAWAL RATES FROM A 30 LB. CYLINDER

AMBIENT TEMP.
5 MPH AIR VELOCITY
15 PSIG (FOR 28 PSIG ADD 20°F)

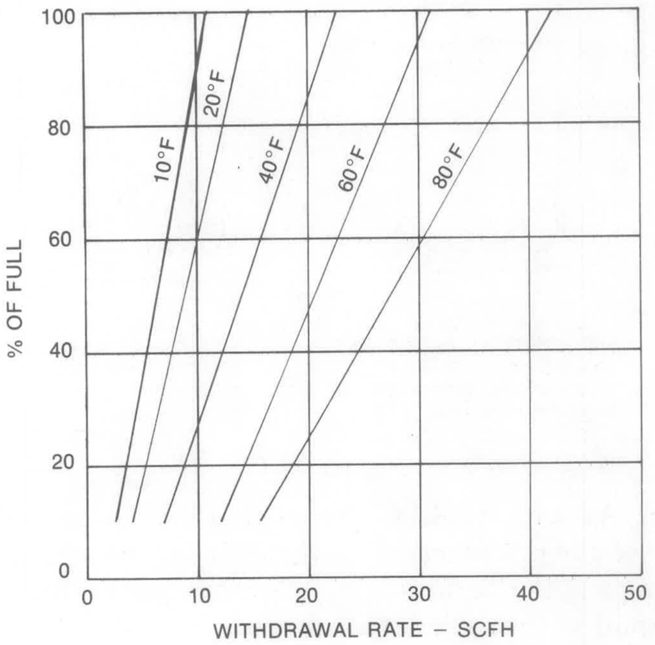


Figure B-7

MAPP® Gas

CONTINUOUS WITHDRAWAL RATES FROM A 70 LB. CYLINDER

AMBIENT TEMP.
5 MPH AIR VELOCITY
15 PSIG (FOR 28 PSIG ADD 20°F)

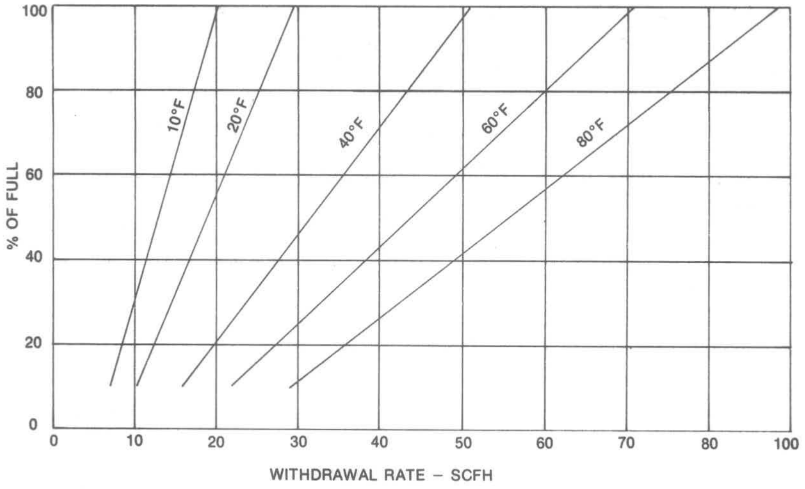


Figure B-8

MAPP® Gas

CONTINUOUS WITHDRAWAL RATES FROM A 115 LB. CYLINDER

AMBIENT TEMP.
5 MPH AIR VELOCITY
15 PSIG (FOR 28 PSIG ADD 20°F)

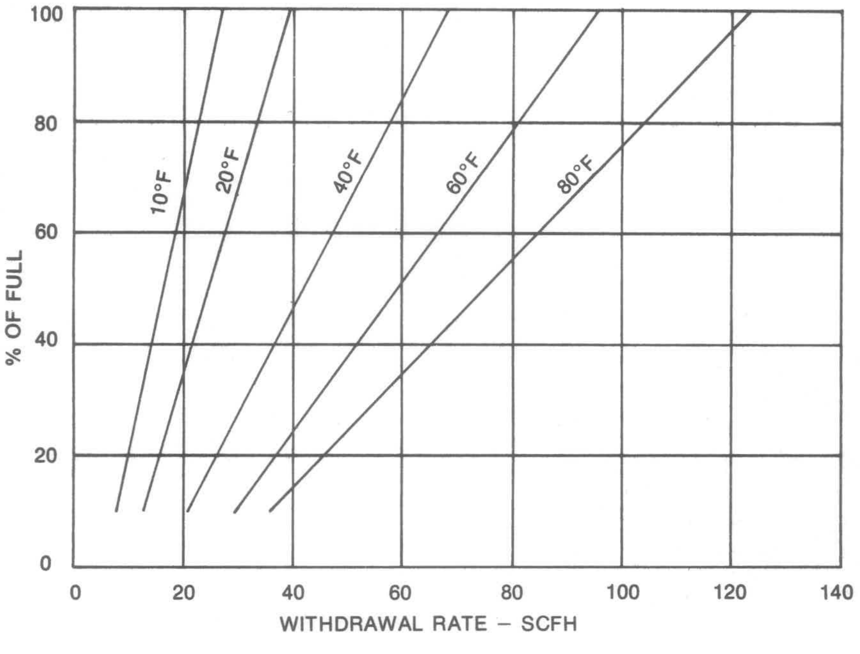


Figure B-9

5. GAS MANIFOLDS AND MANIFOLDING OF CYLINDERS

There are a lot of shops that use gas at a fast rate — so fast that to change over from an emptied cylinder to a full cylinder would be time-consuming as well as annoying. Manufacturers have solved that problem too — with gas manifolds.

There are stationary and portable manifolds and they provide a single output from a number of cylinders. Gas is extracted from the cylinders equally and proper pressures are maintained by pressure regulators about which you will learn more later.

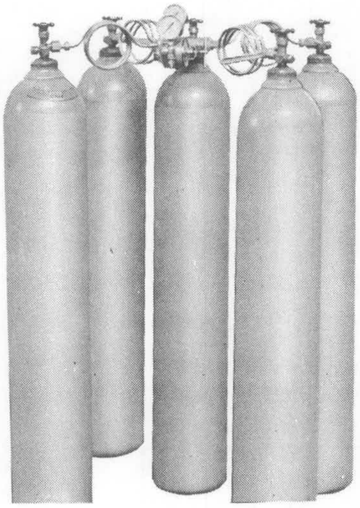


Figure B-10
PORTABLE OXYGEN MANIFOLD

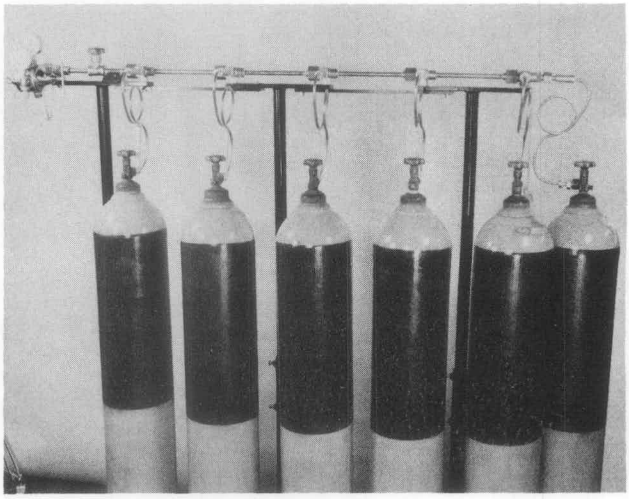


Figure B-12
SIMPLEX SINGLE ROW

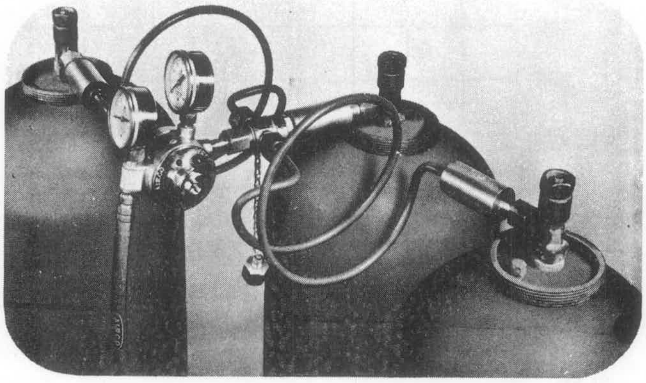


Figure B-11
PORTABLE ACETYLENE MANIFOLD

AIRCO GAS MANIFOLDS

Gas Manifolds are devices designed to connect the outlets of varying numbers of industrial gas cylinders. The combined volume obtained from these cylinders permits doing jobs that require a large supply of gas. Airco Gas Manifolds are available in two basic types—Portable and Stationary, for almost any gas. The portable types for 2, 3, 4 and 5 cylinders are not confined to any particular location. The stationary types the "Simplex" and "Duplex" are supported by stands bolted to the floor. *A Simplex Manifold* consists of a single bank of cylinders in single or double row which requires a momentary interruption of gas supply when replacing the exhausted cylinder.

The Duplex Manifold consists of two banks of cylinders to provide a continuous gas supply. As one bank is exhausted, the other bank is automatically actuated in service. This allows ample time to reload the former bank without gas flow interruption. When distributing gases from a Duplex-type manifold, it is uaually advisable to make this distribution through pipelines with all cylinders concentrated in a special manifold compartment or room in the plant. Such a concentration effects a substantial saving in handling of cylinders.

The National Fire Protection Association Standards for Installation and Operation of Oxygen and Fuel Gas Systems for Welding and Cutting (NFPA Pamphlet No. 51) provides that "Oxygen manifolds to which cylinders having an aggregate capacity of more than 6000 cubic feet of oxygen are connected should preferably be located outside or in a special building.

PORTABLE MANIFOLDS FOR 2, 3, 4 and 5 CYLINDERS

The combined volume of several cylinders provides ample supply for jobs where it is important to avoid interruption of the work.

Being portable, the manifold's use is not confined to any particular location in the shop or yard. It can be readily set up in close proximity to the job or on emergency repair trucks.

The forged brass headers are designed to accomodate two to five cylinders. The header nut and gland connection fits directly on one cylinder valve to provide rigidity to the assembly. The other connections are threaded nipples, one of which is for attaching the regulator while the other nipples accomodates the cylinder coils that in turn are attached to the other cylinders.

Blind glands and nuts are used to plug unused header connections. If originally purchased for use with less than five cylinders, the manifold can at a later time, be increased to maximum capacity merely by the purchase of additional flexible brass cylinder connecting coils.

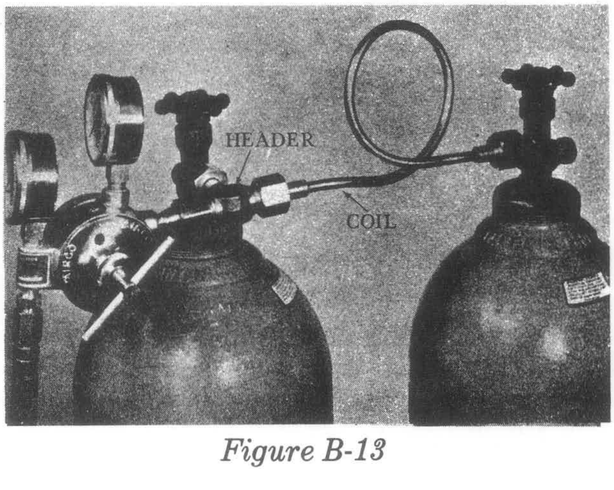


Figure B-13

PORTABLE OXYGEN — NITROGEN — ARGON — HELIUM — HYDROGEN

HOW TO ORDER TWO CYLINDER MANIFOLD

Description	STOCK NUMBERS						
	For Oxygen	For WP Nitrogen	For Argon	For Nitrogen OP	For Helium	For Hydrogen	CO_2
Manifold Header	829-0933	829-0936	829-0936	829-0934	829-0935	829-0935	829-0000
Cylinder Coil	837-4705	837-0937	837-0937	837-4905	837-0938	837-0938	837-0000
Regulator	806-8458	806-9402	806-9407 or 806-9474*	806-8427	806-8418 or 806-8470	806-8403	806-0000

* Flowmeter Regulator.

HOW TO ORDER FIVE CYLINDER MANIFOLD

Description	STOCK NUMBERS					
	For Oxygen	For WP Nitrogen	For Argon	For Nitrogen OP	**For Helium For use with Regulator 806-8817**	**For Helium For use with Regulator 806-8470**
Manifold Header	829-0060	829-0729	829-0060	829-0499	829-0471	829-0831*
Cylinder Coil	837-3411	837-4511 837-4561**	837-3471**	837-4211	837-4311**	837-2387**

NOTE: A regulator must be ordered in addition to the manifold and cylinder coils shown in this table.

* This manifold has threads to fit the 806-8470 flowmeter regulator. Therefore, a customer formerly using a single cylinder with the regulator can increase his gas supply without the expense of a new regulator. Where a customer originally starts out with a multiple cylinder supply, manifold 829-0471 and regulator 806-8817 is recommended.

** Cylinder coils equipped with check valves.

PORTABLE ACETYLENE MANIFOLDS

These portable manifolds are designed for manifolding three or five cylinders of Acetylene. These manifolds are light in weight and can be moved about with ease.

There are three variations of Airco Portable Acetylene cylinder manifolds. One to fit standard Airco cylinders. Two to fit Prestolite cylinders, one of them is for vertical outlet the other is for horizontal outlet. It is therefore necessary to specify the type of cylinders on which the Manifold will be used.

THREE-CYLINDER PORTABLE MANIFOLDS

These manifolds are constructed of a forged brass cross to which is attached a flashback arrester and a cylinder connection. This connection fits directly on the cylinder valve and provide rigidity to the assembly. Also installed in the manifold header are three threaded bosses. One is for attaching the acetylene regulator and the other two for attaching the cylinder connecting coils. These coils are made of seamless tubing and each is equipped with a flashback arrester. A blind gland and nut assembly is secured to the manifold with a light chain to permit the use of two cylinders only if desired.

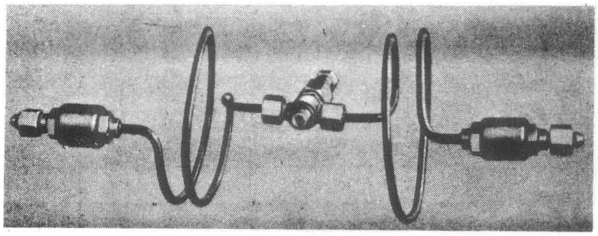


Figure B-13a

THREE CYLINDER PORTABLE MANIFOLD

HOW TO ORDER

	Airco cylinders	Prestolite cylinder vertical outlet	Prestolite cylinder horizontal outlet
Manifold Header	829 7623	829 0423	829 0643
Cylinder Coil	837 0142	837 0186	837 0584
Regulator	806 8402	806 8409	

FIVE CYLINDER PORTABLE MANIFOLDS

The forged brass manifolds headers are designed for three, four or five cylinders. The header and gland connection fits directly on one cylinder valve to provide rigidity to the assembly. The other five connections are threaded nipples one of which is for attaching the regulator. Two blind gland and nut assembly are secured to the manifold with light chains to permit the use of three cylinders if desired.

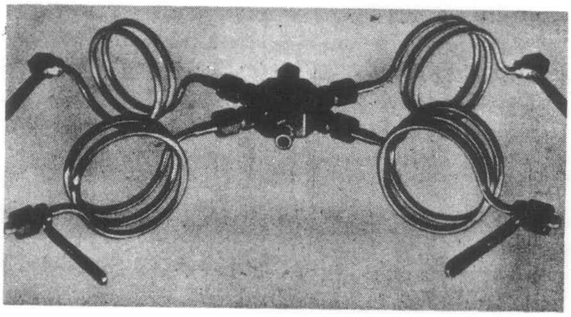


Figure B-13b

FIVE CYLINDER PORTABLE MANIFOLD

HOW TO ORDER

	Airco cylinders	Prestolite cylinder vertical outlet	Prestolite cylinder horizontal outlet
Manifold Header	829 7635	829 0204	829 0645
Cylinder Coil	837 0142	837 0186	837 0589
Regulator		806 8402	

AIRCO STATIONARY MODULAR MANIFOLDS

Airco simplex and duplex stationary manifolds are of the modular type. The threaded module assembly is designed to give flexibility to the system, by attaching it to the valve module assembly and permits expansion of the system. It utilizes metal to metal seal and silver solder joints for greater durability.

Ordering Airco modular manifolds is simple. Once you know the gas you are using, and whether you want a simplex or duplex manifold, then by just looking at the proper charts you pick the assembly number.

The Bill of Material spells out all that is needed. The modular manifold is complete. This was designed to make the job of selecting the right manifold easier. In each manifold shipment an instruction manual is provided.

The header of Airco modular stationary manifolds are constructed of 3/8 ips extra heavy brass pipes and crosses of forged brass. All fittings are silver brazed to take advantage of the full wall thickness of the pipe throughout. The assembled pipe and crosses are bolted to joiner plates to provide support for the manifold. The manifold header is supported by floor stands. Holes are provided at the base of these stands to secure them to the floor.

SIMPLEX MANIFOLDS

The Simplex stationary manifolds insure large gas supply from a single source. This type of manifold requires the shop pipeline service be discontinued while cylinders are being replaced.

One end of the Simplex manifold (Fig. B-14) consists of a module which includes a larger pressure shut-off valve and an outlet fitting to connect a pressure regulator.

Simplex manifolds are designed for either single or double row of cylinders. The smallest Simplex manifold will accomodate five cylinders. Extra module tees or crosses must be installed for additional cylinders.

Airco Simplex-type Manifolds are designed to accommodate only one bank of cylinders which may be either in single or double row arrangement.

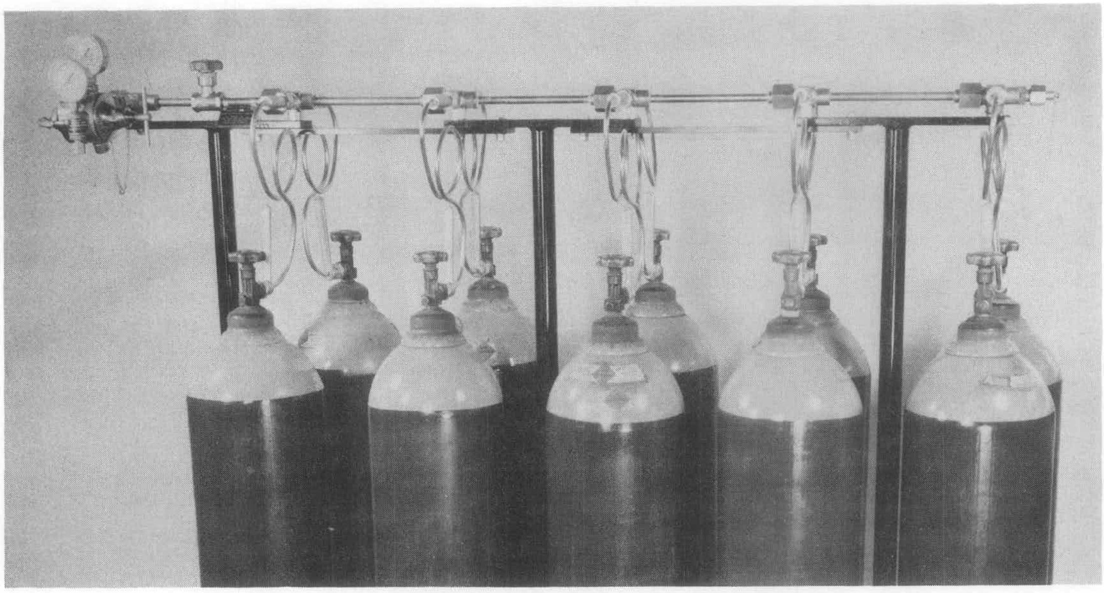


Figure B-14
SIMPLEX STATIONARY MANIFOLD – DOUBLE ROW

HOW TO ORDER
OXYGEN MANIFOLD
SINGLE-ROW SIMPLEX

STOCK NUMBER	ITEM DESCRIPTION	NUMBER OF CYLINDERS					
		5	6	7	8	9	10
		MANIFOLD ASSY. NOS.					
		829 4501	829 4502	829 4503	829 4504	829 4505	829 4506
		QTY. OF ITEMS INCLUDED					
806 8800	Regulator-Max. CFH Flow 4000/Press. 150	1	1	1	1	1	1
829 4567	Regulator Tee & Valve Module Assy.	1	1	1	1	1	1
829 4471	Oxygen Coil Assy.	5	6	7	8	9	10
829 4611	Tee Module Assy.	4	4	6	6	8	8
829 4630	Tee Adapter Assy.	1	1	1	1	1	1
829 4558	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	1	1	1	1	1
829 4435	Manifold Bottom Stand Assy.	3	3	4	4	5	5
829 4440	Manifold Top Stand Assy.	3	3	4	4	5	5
829 4462	Joiner Plate	2	2	3	3	4	4
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	20	20	26	26
9205 6300	Washer Lock STL. CAD PL. 3/8 MED.	10	10	14	14	18	18
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	6	6	8	8
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
829 4677	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER
OXYGEN MANIFOLD
DOUBLE-ROW SIMPLEX

STOCK NUMBER	ITEM DESCRIPTION	NUMBER OF CYLINDERS					
		10	11	12	13	14	15
		MANIFOLD ASSY. NOS.					
		829 4550	829 4551	829 4552	829 4553	829 4554	829 4555
		QTY. OF ITEMS INCLUDED					
806 8800	Regulator-Max. CFH Flow 4000/Press. 200	1	1	1	1	1	1
829 4567	Regulator Tee & Valve Module Assy.	1	1	1	1	1	1
829 4471	Oxygen Coil Assy.	10	11	12	13	14	15
829 4628	Cross Module Assy.	4	4	6	6	8	8
829 4632	Cross Adapter Assy.	1	1	1	1	1	1
829 4558	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	1	1	1	1	1
829 4435	Manifold Bottom Stand Assy.	3	3	4	4	5	5
829 4440	Manifold Top Stand Assy.	3	3	4	4	5	5
829 4462	Joiner Plate	2	2	3	3	4	4
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	20	20	26	26
9205 6300	Washer Lock STL. CAD PL. 3/8 MED.	10	10	14	14	18	18
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	6	6	8	8
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
829 4677	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER
ARGON-HELIUM-NITROGEN MANIFOLD
SINGLE-ROW SIMPLEX

		NUMBER OF CYLINDERS					
		5	6	7	8	9	10
		MANIFOLD ASSY. NOS.					
		*829 4509	*829 4510	*829 4511	*829 4512	*829 4513	*829 4514
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8824	Regulator-Max. CFH Flow — /Press. 200	1	1	1	1	1	1
829 4568	Regulator Tee & Valve Module Assy.	1	1	1	1	1	1
*	Argon-Helium-Nitrogen Coil Assy.	5*	6*	7*	8*	9*	10*
829 4627	Tee Module Assy.	4	4	6	6	8	8
829 4631	Tee Adapter Assy.	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	1	1	1	1	1
829 4435	Manifold Bottom Stand Assy.	3	3	4	4	5	5
829 4440	Manifold Top Stand Assy.	3	3	4	4	5	5
829 4462	Joiner Plate	2	2	3	3	4	4
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	20	20	26	26
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	14	14	18	18
9201 5243	Nut STL. CAD PL. Hex 3/8-16	4	4	6	6	8	8
9204 3213	SCR. CAP STL. CAD PL. Hex HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
829 4680	Nameplate Kit	1	1	1	1	1	1

* NOTE: Since a great number of high pressure gas cylinder valves do not conform to current CGA standards, to order **Coil Assemblies**, it is imperative that the cylinder valve thread size be known—major diameter, number of threads per inch, external or internal.

The Manifold Assembly Numbers above do not include Coil Assemblies. Coil Assemblies must be ordered by Stock Number listed in "Coil Assembly Reference Item 3". Order the quantity of Coils listed on line 3 under the Manifold Assembly Number specified on the order.

COIL ASSY. REF. ITEM — 3

STOCK NO.	CYL. OUTLET THD.
829 4474	.965-14 NGO RH INT. CGA # 580
829 4481	.903-14 NGO RH EXT. CGA # 540
829 4468	.825-14 NGO LH EXT. CGA # 350

HOW TO ORDER
ARGON-HELIUM-NITROGEN MANIFOLD DOUBLE-ROW SIMPLEX

		NUMBER OF CYLINDERS					
		10	11	12	13	14	15
		MANIFOLD ASSY. NOS.					
		*829 4560	*829 4561	*829 4562	*829 4563	*829 4564	*829 4565
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8824	Regulator-Max. CFH Flow /Press. 200	1	1	1	1	1	1
829 4568	Regulator Tee & Valve Module Assy.	1	1	1	1	1	1
*	Argon-Helium-Nitrogen Coil Assy.	10*	11*	12*	13*	14*	15*
829 4629	Cross Module Assy.	4	4	6	6	8	8
829 4633	Cross Adapter Assy.	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	1	1	1	1	1
829 4435	Manifold Bottom Stand Assy.	3	3	4	4	5	5
829 4440	Manifold Top Stand Assy.	3	3	4	4	5	5
829 4462	Joiner Plate	2	2	3	3	4	4
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	20	20	26	26
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	14	14	18	18
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	6	6	8	8
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
829 4680	Nameplate Kit	1	1	1	1	1	1

* NOTE: Since a great number of high pressure gas cylinder valves do not conform to current CGA standards, to order **Coil Assemblies**, it is imperative that the cylinder valve thread size be known—major diameter, number of threads per inch, external or internal.

The Manifold Assembly Numbers above do not include Coil Assemblies. Coil Assemblies must be ordered by Stock Number listed in "Coil Assembly Reference Item 3". Order the quantity of Coils listed on line 3 under the Manifold Assembly Number specified on the order.

COIL ASSY. REF. ITEM — 3

STOCK NO.	CYL. OUTLET THD.
829 4474	.965-14 NGO RH INT CGA # 580
829 4481	.903-14 NGO RH EXT CGA #540
829 4468	.825-14 NGO LH EXT CGA # 350

DUPLEX MODULAR MANIFOLDS

Airco Duplex-type manifolds permit the use of two individual banks of cylinders, each connected to a common modular header and each controlled independently of the other by means of high pressure control valves mounted in the duplex valve module assembly. These manifolds can be obtained for either single or double row arrangement depending on the floor space available.

Duplex type manifolds are the most practical type for shop pipeline service because their use assures uninterrupted gas supply. While one bank of cylinders is delivering gas, the empty cylinders on the other bank can be replaced with full ones. When the former bank is exhausted, the latter bank is then released manually or automatically.

Installed in the center of the header are three high pressure control valves. Two individually control their respective banks. The third positioned between the two regulator connection fittings is to govern the use of only one regulator with its respective bank, or both regulators in parallel with either bank.

Airco Duplex manifolds are of modular type, which means that the basic manifold can be increased in size to any desired capacity at the time of installation or at a later date.

The Basic Duplex manifold or center section is available for 2 cylinders in a single row or 4 cylinders in double row. It can be extended by adding extension headers up to 14 cylinders on single row or up to 26 cylinders on double row.

These manifolds are specifically designed to provide the customer with the greatest possible degree of flexibility in planning his manifold installation.

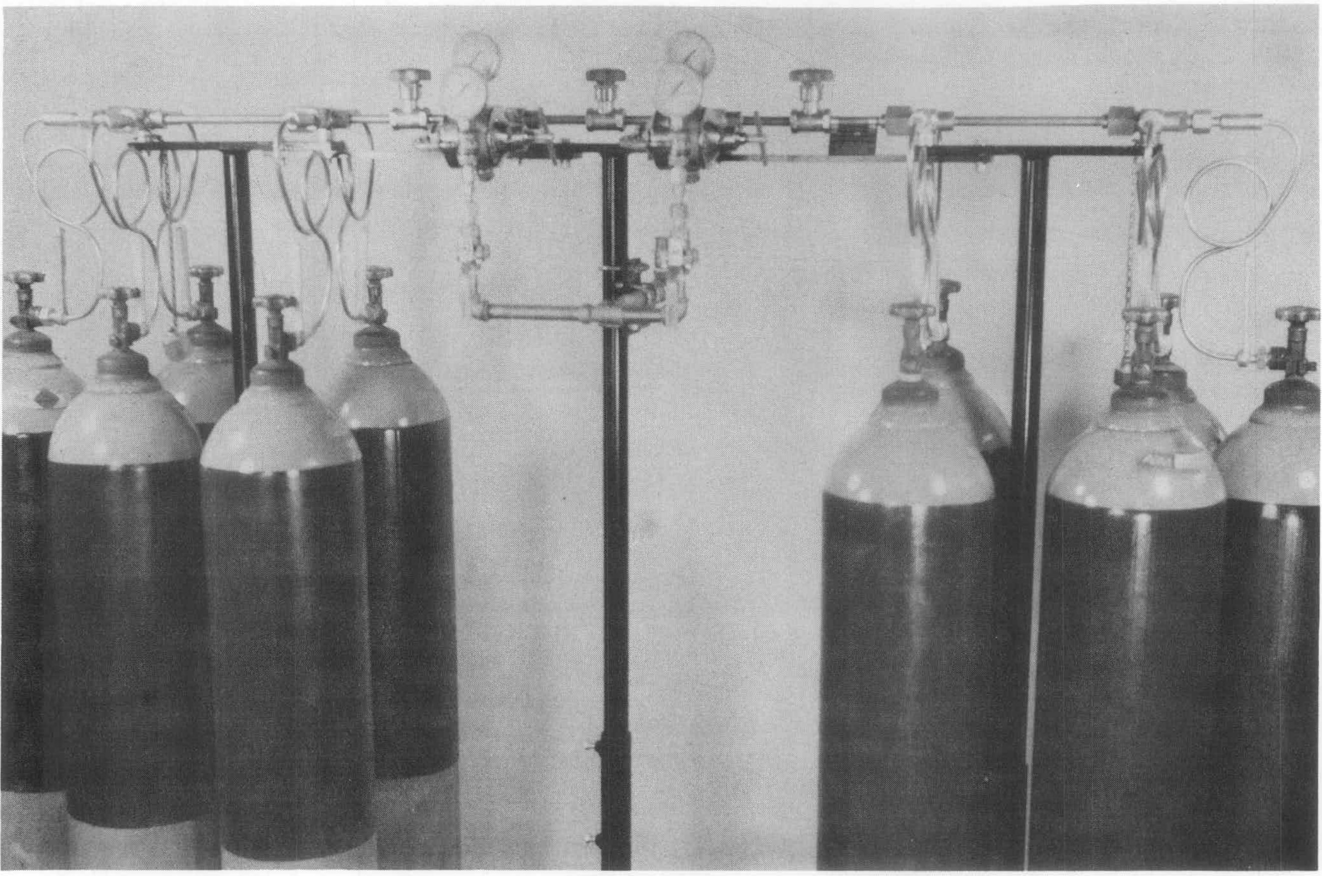


Figure B-15
DUPLEX STATIONARY MANIFOLD – DOUBLE ROW

HOW TO ORDER OXYGEN MANIFOLD SINGLE-ROW DUPLEX

		NUMBER OF CYLINDERS					
		4	6	8	10	12	14
		MANIFOLD ASSY. NOS.					
		829 4515	829 4516	829 4517	829 4518	829 4519	829 4520
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8800	Regulator-Max. CFH Flow 4000/Press. 200	2	2	2	2	2	2
829 4611	Tee Module Assy.	2	2	6	6	10	10
829 4630	Tee Adapter Assy.	1	1	1	1	1	1
829 4471	Oxygen Coil Assy.	4	6	8	10	12	14
829 4665	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4443	Service Line Valve & Support Assy.	1	1	1	1	1	1
829 4558	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4416	Adapter	2	2	2	2	2	2
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
829 4462	Joiner Plate	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	8	8	12	12
829 4494	Adapter	0	1	0	1	0	1
829 4677	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER
OXYGEN MANIFOLD DOUBLE-ROW DUPLEX

		NUMBER OF CYLINDERS					
		8	10	16	18	24	26
		MANIFOLD ASSY. NOS.					
		829 4575	829 4576	829 4577	829 4578	829 4579	829 4580
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8800	Regulator-Max. CFH Flow 4000/Press. 150	2	2	2	2	2	2
829 4628	Cross Module Assy.	2	2	6	6	10	10
829 4632	Cross Adapter Assy.	1	1	1	1	1	1
829 4471	Oxygen Coil Assy.	8	10	16	18	24	26
829 4667	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4443	Service Line Valve & Support Assy.	1	1	1	1	1	1
829 4558	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4416	Adapter	2	2	2	2	2	2
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
829 4462	Joiner Plate	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	8	8	12	12
829 4494	Adapter	0	1	0	1	0	1
829 4677	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER ARGON-HELIUM-NITROGEN MANIFOLD SINGLE-ROW DUPLEX

		NUMBER OF CYLINDERS					
		4	6	8	10	12	14
		MANIFOLD ASSY. NOS.					
		*829 4522	*829 4523	*829 4524	*829 4525	*829 4526	*829 4527
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8824	Regulator-Max. CFH Flow /Press. 200	2	2	2	2	2	2
829 4627	Tee Module Assy.	2	2	6	6	10	10
829 4631	Tee Adapter Assy.	1	1	1	1	1	1
*	Argon-Helium-Nitrogen Coil Assy.	4*	6*	8*	10*	12*	14*
829 4666	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4443	Service Line Valve & Support Assy.	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4413	Adapter Assy.	2	2	2	2	2	2
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
829 4462	Joiner Plate	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	8	8	12	12
829 4492	Adapter	0	1	0	1	0	1
829 4680	Nameplate Kit	1	1	1	1	1	1

* NOTE: Since a great number of high pressure gas cylinder valves do not conform to current CGA standards, to order **Coil Assemblies**, it is imperative that the cylinder valve thread size be known—major diameter, number of threads per inch, external or internal.

The Manifold Assembly Numbers above do not include Coil Assemblies. Coil Assemblies must be ordered by Stock Number listed in "Coil Assembly Reference Item 4". Order the quantity of Coils listed on line 4 under the Manifold Assembly Number specified on the order.

COIL ASSY. REF. ITEM 4

STOCK NO.	CYL. OUTLET THD.
829 4474	.965-14 NGO RH INT CGA# 580
829 4481	.903-14 NGO RH EXT CGA# 540
829 4468	.825-14 NGO LH EXT CGA# 350

HOW TO ORDER ARGON-HELIUM-NITROGEN MANIFOLD DOUBLE-ROW DUPLEX

		NUMBER OF CYLINDERS					
		8	10	16	18	24	26
		MANIFOLD ASSY. NOS.					
		*829 4582	*829 4583	*829 4584	*829 4585	*829 4586	*829 4587
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8824	Regulator-Max. CFH Flow /Press. 200	2	2	2	2	2	2
829 4629	Cross Module Assy.	2	2	6	6	10	10
829 4633	Cross Adapter Assy.	1	1	1	1	1	1
*	Argon-Helium-Nitrogen Coil Assy.	8*	10*	16*	18*	24*	26*
829 4668	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4443	Service Line Valve & Support Assy.	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4413	Adapter Assy.	2	2	2	2	2	2
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
829 4462	Joiner Plate	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. HEX 3/8-16	4	4	8	8	12	12
829 4492	Adapter	0	1	0	1	0	1
829 4680	Nameplate Kit	1	1	1	1	1	1

* NOTE: Since a great number of high pressure gas cylinder valves do not conform to current CGA standards, to order **Coil Assemblies**, it is imperative that the cylinder valve thread size be known—major diameter, number of threads per inch, external or internal.

The Manifold Assembly Numbers above do not include Coil Assemblies. Coil Assemblies must be ordered by Stock Number listed in "Coil Assembly Reference Item 4". Order the quantity of Coils listed on line 4 under the Manifold Assembly Number specified on the order.

COIL ASSY. REF. ITEM — 4

STOCK NO.	CYL. OUTLET THD.
829 4474	.965-14 NGO RH INT CGA# 580
829 4481	.903-14 NGO RH EXT CGA# 540
829 4468	.825-14 NGO LH EXT CGA# 350

HYDROGEN MANIFOLD

Hydrogen cylinder manifolds come in duplex type only, single and double row. They are designed for two types of services. One is similar in appearance to the other Airco manifolds, it is referred as "Dry type". It is used for operation not involving combustion as in blanketing. The other type includes a flashback arrestor necessary when hydrogen is used as a fuel.

HOW TO ORDER SINGLE-ROW DUPLEX, DRY TYPE MANIFOLD

		NUMBER OF CYLINDERS					
		4	6	8	10	12	14
		MANIFOLD ASSY. NOS.					
		829 4535	829 4536	829 4537	829 4538	829 4539	829 4540
STOCK NUMBER	**ITEM DESCRIPTION**	**QTY. OF ITEMS INCLUDED**					
806 8413	Regulator-Max. CFH Flow 1000/Press. 40	2	2	2	2	2	2
829 4627	Tee Module Assy.	2	2	6	6	10	10
829 4631	Tee Adapter Assy.	1	1	1	1	1	1
829 4468	Hydrogen Coil Assy.	4	6	8	10	12	14
829 4659	Duplex Valve Module Assy.	1	1	1	1	1	1
837 4804	Hydrogen Manifold Service Line Conn. (Dry)	1	1	1	1	1	1
829 4738	Clamp Bar	1	1	1	1	1	1
829 4496	Support Angle	1	1	1	1	1	1
829 4462	Joiner Plate	2	2	4	4	6	6
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	18	18	30	30	42	42
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	12	12	20	20	28	28
9204 4049	SCR. CAD STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. 3/8-16	6	6	10	10	14	14
9204 4051	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-3/4	2	2	2	2	2	2
829 4492	Adapter	0	1	0	1	0	1
829 4679	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER DOUBLE-ROW DUPLEX, DRY TYPE MANIFOLD

STOCK NUMBER	ITEM DESCRIPTION	NUMBER OF CYLINDERS 8	10	16	18	24	26
		MANIFOLD ASSY. NOS. 829 4601	829 4602	829 4603	829 4604	829 4605	829 4606
		QTY. OF ITEMS INCLUDED					
806 8413	Regulator-Max. CFH Flow 1000/Press. 40	2	2	2	2	2	2
829 4629	Cross Module Assy.	2	2	6	6	10	10
829 4633	Cross Adapter Assy.	1	1	1	1	1	1
829 4468	Hydrogen Coil Assy.	8	10	16	18	24	26
829 4660	Duplex Valve Module Assy.	1	1	1	1	1	1
837 4804	Hydrogen Manifold Service Line Conn. (Dry)	1	1	1	1	1	1
829 4738	Clamp Bar	1	1	1	1	1	1
829 4496	Support Angle	1	1	1	1	1	1
829 4462	Joiner Plate	2	2	4	4	6	6
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	3	3	5	5	7	7
829 4440	Manifold Top Stand Assy.	3	3	5	5	7	7
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	18	18	30	30	42	42
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	12	12	20	20	28	28
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. 3/8-16	6	6	10	10	14	14
9204 4051	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-3/4	2	2	2	2	2	2
829 4492	Adapter	0	1	0	1	0	1
829 4679	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER SINGLE-ROW DUPLEX MANIFOLD WITH HYDRAULIC ARRESTOR

		NUMBER OF CYLINDERS					
		4	6	8	10	12	14
		MANIFOLD ASSY. NOS.					
		829 4542	829 4543	829 4544	829 4545	829 4546	829 4547
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8803	Regulator-Max. CFH Flow 10,000/Press. 200	2	2	2	2	2	2
829 4627	Tee Module Assy.	2	2	6	6	10	10
829 4631	Tee Adapter Assy.	1	1	1	1	1	1
829 4468	Hydrogen Coil Assy.	4	6	8	10	12	14
829 4661	Duplex Valve Module Assy.	1	1	1	1	1	1
837 4803	Hydrogen Manifold Service Line Conn. (Hydraulic)	1	1	1	1	1	1
829 4462	Joiner Plate	2	2	4	4	6	6
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	2	2	4	4	6	6
829 4440	Manifold Top Stand Assy.	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. 3/8-16	4	4	8	8	12	12
829 4492	Adapter	0	1	0	1	0	1
829 4679	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER DOUBLE-ROW DUPLEX MANIFOLD WITH HYDRAULIC ARRESTOR

STOCK NUMBER	ITEM DESCRIPTION	NUMBER OF CYLINDERS					
		8	10	16	18	24	26
		MANIFOLD ASSY. NOS.					
		829 4613	829 4614	829 4615	829 4616	829 4617	829 4618
		QTY. OF ITEMS INCLUDED					
806 8803	Regulator-Max. CFH Flow 10,000/Press. 200	2	2	2	2	2	2
829 4629	Cross Module Assy.	2	2	6	6	10	10
829 4633	Cross Adapter Assy.	1	1	1	1	1	1
829 4468	Hydrogen Coil Assy.	8	10	16	18	24	26
829 4662	Duplex Valve Module Assy.	1	1	1	1	1	1
837 4803	Hydrogen Manifold Service Line Conn. (Hydraulic)	1	1	1	1	1	1
829 4462	Joiner Plate	2	2	4	4	6	6
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	2	2	4	4	6	6
829 4440	Manifold Top Stand Assy.	2	2	4	4	6	6
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	14	14	26	26	38	38
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	10	10	18	18	26	26
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	16	16	24	24
9201 5243	Nut STL. CAD PL. 3/8-16	4	4	8	8	12	12
829 4492	Adapter	0	1	0	1	0	1
829 4679	Nameplate Kit	1	1	1	1	1	1

CARBON DIOXIDE DUPLEX MANIFOLDS

Airco carbon dioxide manifolds come in manually operated duplex type only. The duplex valve module assembly at the center of the manifold assembly has two high pressure valves, one on each side of the module outlet. From there the gas passes through an electrical heater before entering the gas pressure regulator. As high pressure carbon dioxide expands, the regulator freezes at continuous flows greater than 6 pounds-per-hour or 50 cubic-feet-per-hour. The automatic thermostatic-controlled heaters insure a uniform temperature and a continuous flow.

NOTE: For operations using more than 1000 pounds per 8 hours two or more heaters mounted in series are needed.

HEATERS

Stock No.	Max. Lbs. Per 8 Hrs.	Voltage	Wattage	Conn.
851 4254	500	120	500	Inlet
851 4255		220		CGA-320
851 4257	1000	120	1000	Outlet
851 4259		220		1.047-12

Heater to be ordered separately on LPA# 11-47-G.

HOW TO ORDER SINGLE-ROW DUPLEX MANIFOLD

		NUMBER OF CYLINDERS					
		8	10	12	14	16	18
		MANIFOLD ASSY. NOS.					
		829 4528	829 4529	829 4530	829 4531	829 4532	829 4533
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8875	Regulator-Max. CFH Flow 2600/Press. 200	1	1	1	1	1	1
829 4627	Tee Module Assy.	6	6	10	10	14	14
829 4631	Tee Adapter Assy.	1	1	1	1	1	1
829 4463	Carbon Dioxide Coil Assy.	8	10	12	14	16	18
829 4492	Adapter	0	1	0	1	0	1
829 4663	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4477	Spacer Plate	1	1	1	1	1	1
837 3836	Adapter Assy.	1	1	1	1	1	1
See Chart	Heater	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	4	4	6	6	8	8
829 4440	Manifold Top Stand Assy.	4	4	6	6	8	8
829 4462	Joiner Plate	2	2	4	4	6	6
829 4478	Joiner Angle	1	1	1	1	1	1
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	21	21	33	33	45	45
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	15	15	23	23	31	31
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9204 4033	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/4	5	5	5	5	5	5
9201 5243	Nut STL. CAD PL. HEX 3/8-16	6	6	10	10	14	14
829 4678	Nameplate Kit	1	1	1	1	1	1

HOW TO ORDER
DOUBLE-ROW DUPLEX MANIFOLD

		NUMBER OF CYLINDERS					
		16	18	24	26	32	34
		MANIFOLD ASSY. NOS.					
		829 4589	829 4590	829 4591	829 4592	829 4593	829 4594
STOCK NUMBER	ITEM DESCRIPTION	QTY. OF ITEMS INCLUDED					
806 8875	Regulator-Max. CFH Flow 2600/Press. 200	1	1	1	1	1	1
829 4629	Cross Module Assy.	6	6	10	10	14	14
829 4633	Cross Adapter Assy.	1	1	1	1	1	1
829 4463	Carbon Dioxide Coil Assy.	16	18	24	26	32	34
829 4492	Adapter	0	1	0	1	0	1
829 4664	Duplex Valve Module Assy.	1	1	1	1	1	1
829 4477	Spacer Plate	1	1	1	1	1	1
837 3836	Adapter Assy.	1	1	1	1	1	1
See Chart	Heater	1	1	1	1	1	1
829 4557	Plug & Chain Assy.	1	0	1	0	1	0
829 4559	Plug & Chain Assy.	1	0	1	0	1	0
829 4435	Manifold Bottom Stand Assy.	4	4	6	6	8	8
829 4440	Manifold Top Stand Assy.	4	4	6	6	8	8
829 4462	Joiner Plate	2	2	4	4	6	6
829 4478	Joiner Angle	1	1	1	1	1	1
9204 3213	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/8	2	2	2	2	2	2
9205 6007	Washer Plain STL. CAD PL. .401 x .812 x .065	21	21	33	33	45	45
9205 6300	Washer Lock STL. CAD PL. 3/8 Med.	15	15	23	23	31	31
9204 4049	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/2	8	8	12	12	16	16
9204 4033	SCR. CAP STL. CAD PL. HEX HD. 3/8-16 x 1-1/4	5	5	5	5	5	5
9201 5243	Nut STL. CAD PL. 3/8-16	6	6	10	10	16	16
829 4678	Nameplate Kit	1	1	1	1	1	1

HEATERS

Stock No.	Max. Lbs. Per 8 Hrs.	Voltage	Wattage	Conn.
851 4254	500	120	500	Inlet
851 4255		220		CGA-320
851 4257	1000	120	1000	Outlet
851 4259		220		1.047-12

Heater to be ordered separately on LPA # 11-47-G.

6. GAS DISTRIBUTION SYSTEMS AND SAFETY STANDARDS

INTRODUCTION

Manifolds are frequently used to feed in-plant, pipeline gas distribution systems. Although the reasoning for installing an in-plant system may be sound, execution is an altogether different matter. There are very stringent regulations governing the installation of such systems. The purpose of this Section is to give you an idea of the extent of the regulations—and hopefully, to give you some "feel" for the details that must be considered. Before recommending that a customer install a pipeline system, you will be in his good stead if you could brief him on the various types of accessory equipment he'll need and the procedures with which he will be expected to conform.

Regulations for gas distribution systems are spelled out in the American National Standard Institute (ANSI) pamphlet Z49.1. The same recommendations are stated in the National Fire Prevention Association pamphlet 51.4. For your reference, the following is the section of OSHA, Sub Part Q — Welding, Cutting and Brazing, Pages 530 thru 534 Service Piping Systems. This is the newest government regulation formulated from Z49.1 and NFPA 51.4.

STANDARDS AND INTERPRETATIONS

under the supervision of someone familiar with the proper practices with reference to their construction and use.

(b) All component parts used in the methods of manifolding described in subdivision (i) of this subdivision shall be approved as to materials, design and construction either separately or as an assembled unit.

(c) All manifolds and parts used in methods of manifolding shall be used only for the gas or gases for which they are approved.

(d) When acetylene cylinders are coupled, approved flash arresters shall be installed between each cylinder and the coupler block. For outdoor use only, and when the number of cylinders coupled does not exceed three, one flash arrester installed between the coupler block and regulator is acceptable.

(e) Each fuel-gas cylinder lead should be provided with a backflow check valve.

(f) The aggregate capacity of fuel-gas cylinders connected to a portable manifold inside a building shall not exceed 3,000 cubic feet of gas.

(g) Acetylene and liquified fuel-gas cylinders shall be manifolded in a vertical position.

(h) The pressure in the gas cylinders connected to and discharged simultaneously through a common manifold shall be approximately equal.

(4) Service piping systems.

(i) Materials and design.

(a)

(1) Piping and fittings shall comply with Section 2, Industrial Gas and Air Piping Systems, of the American National Standard Code for Pressure Piping ANSI B31.1, 1967, insofar as it does not conflict with subdivisions (*i*) and (*ii*) of this subdivision:

(i) Pipe shall be at least Schedule 40 and fittings shall be at least standard weight in sizes up to and including 6-inch nominal.

(ii) Copper tubing shall be Types K or L in accordance with the Standard Specification for Seamless Copper Water Tube, ASTM B88–66a.

(2) Piping shall be steel, wrought iron, brass or copper pipe, or seamless copper, brass or stainless steel tubing, except as provided in (*b*) and (*c*) of this subdivision.

(b)

(1) Oxygen piping and fittings at pressures in excess of 700 p.s.i.g., shall be stainless steel or copper alloys.

(2) Hose connections and hose complying with subparagraph (5)(v) of this paragraph may be used to connect the outlet of a manifold pressure regulator to piping providing the working pressure of the piping is 250 p.s.i.g. or less and the length of the hose does not exceed 5 feet. Hose shall have a minimum bursting pressure of 1,000 p.s.i.g.

(3) When oxygen is supplied to a service piping system from a low-pressure oxygen manifold without an intervening pressure regulating device, the piping system shall have a minimum design pressure of 250 p.s.i.g. A pressure regulating device shall be used at each station outlet when the connected equipment is for use at pressures less than 250 p.s.i.g.

(c)

(1) Piping for acetylene or acetylenic compounds shall be steel or wrought iron.

(2) Unalloyed copper shall not be used for acetylene or acetylenic compounds except in listed equipment.

(ii) Piping joints.

(a) Joints in steel or wrought iron piping shall be welded, threaded or flanged. Fittings, such as ells, tees, couplings, and unions, may be rolled, forged or cast steel, malleable iron or nodular iron. Gray or white cast iron fittings are prohibited.

(b) Joints in brass or copper pipe shall be welded, brazed, threaded, or flanged. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800° F.) filler metal.

(c) Joints in seamless copper, brass, or stainless steel tubing shall be approved gas tubing fittings or the joints shall be brazed. If of the socket type, they shall be brazed with silver-brazing alloy or similar high melting point (not less than 800° F.) filler metal.

(iii) Installation.

(a) Distribution lines shall be installed and maintained in a safe operating condition.

(b) Piping located inside or outside of buildings may be placed above or below ground. All piping shall be run as directly as practicable, protected against physical damage, proper allowance being made for expansion and contraction, jarring and vibration. Pipe laid underground in earth shall be located below the frost line and protected against corrosion. After assembly, piping shall be thoroughly blown out with air, nitrogen, or carbon dioxide to remove foreign materials. For oxygen piping, only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used.

(c) Only piping which has been welded or brazed shall be installed in tunnels, trenches or ducts. Shutoff valves shall be located outside such conduits. Oxygen piping may be placed in the same tunnel, trench or duct with fuel-gas pipelines, provided there is good natural or forced ventilation.

(d) Low points in piping carrying moist gas shall be drained into drip pots constructed so as to permit pumping or draining out the condensate at necessary intervals. Drain valves shall be installed for this purpose having outlets normally closed with screw caps or plugs. No open end valves or petcocks shall be used, except that in drips located out of doors, underground, and not readily accessible, valves may be used at such points if they are equipped with means to secure them in the closed position. Pipes leading to the surface of the ground shall be cased or jacketed where necessary to prevent loosening or breaking.

(e) Gas cocks or valves shall be provided for all buildings at points where they will be readily accessible for shutting off the gas supply to these buildings in any emergency. Underground valve boxes or manholes should be avoided wherever possible. There shall also be provided a shutoff valve in the discharge line from the generator, gas holder, manifold or other source of supply.

(f) Shutoff valves shall not be installed in safety relief lines in such a manner that the safety relief device can be rendered ineffective.

(g) Fittings and lengths of pipe shall be examined internally before assembly and, if necessary, freed from scale or dirt. Oxygen piping and fittings shall be washed out with a suitable solution which will effectively remove grease and dirt but will not react with oxygen. Hot water solutions of caustic soda or trisodium phosphate are effective cleaning agents for this purpose.

(h) Piping shall be thoroughly blown out after assembly to remove foreign materials. For oxygen piping, oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used. For other piping, air or inert gas may be used.

(i) When flammable gas lines or other parts of equipment are being purged of air or gas, open lights or other sources of ignition shall not be permitted near uncapped openings.

(j) No welding or cutting shall be performed on an acetylene or oxygen pipeline, including the attachment of hangers or supports, until the line has been purged. Only oil-free air, oil-free nitrogen, or oil-free carbon dioxide shall be used to purge oxygen lines.

(iv) Painting and signs.

(a) Underground pipe and tubing and outdoor ferrous pipe and tubing shall be covered or painted with a suitable material for protection against corrosion.

(b) Aboveground piping systems shall be marked in accordance with the American National Standard Scheme for the Identification of Piping Systems, ANSI A13.1-1956.

(c) Station outlets shall be marked to indicate the name of the gas.

(v) Testing.

(a) Piping systems shall be tested and proved gas tight at 1½ times the maximum operating pressure, and shall be thoroughly purged of air before being placed in service. The material used for testing oxygen lines shall be oil free and noncombustible. Flames shall not be used to detect leaks.

(b) When flammable gas lines or other parts of equipment are being purged of air or gas, sources of ignition shall not be permitted near uncapped openings.

(5) Protective equipment, hose, and regulators.

(i) General. Equipment shall be installed and used only in the service for which it is approved and as recommended by the manufacturer.

(ii) Pressure relief devices. Service piping systems shall be protected by pressure relief devices set to function at not more than the design pressure of the systems and discharging upwards to a safe location.

(iii) Piping protective equipment.

(a) The fuel-gas and oxygen piping systems, including portable outlet headers shall incorporate the protective equipment shown in Figures Q-1, Q-2, and Q-3.

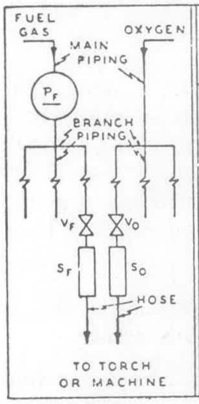


Fig. Q-1

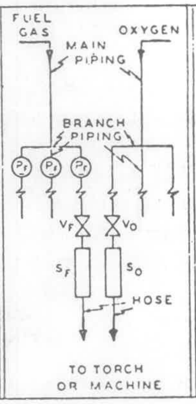


Fig. Q-2

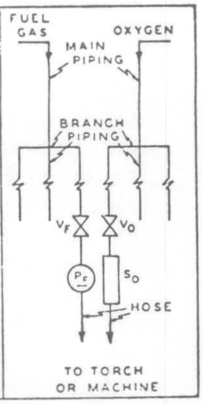


Fig. Q-3

LEGEND

P_F — Protective equipment in fuel gas piping
V_F — Fuel gas station outlet valve
V_O — Oxygen station outlet valve
S_F — Backflow prevention device(s) at fuel gas station outlet
S_O — Backflow prevention device(s) at oxygen station outlet

When only a portion of a fuel-gas system is to be used with oxygen, only that portion need comply with subparagraph (5)(iii)(a) of this paragraph.

(b) Approved protective equipment (designated P_F in Figs. Q-1, Q-2, and Q-3) shall be installed in fuel-gas piping to prevent:

(1) Backflow of oxygen into the fuel-gas supply system;

(2) Passage of a flash back into the fuel-gas supply system; and

(3) Excessive back pressure of oxygen in the fuel-gas supply system. The three functions of the protective equipment may be combined in one device or may be provided by separate devices.

(i) The protective equipment shall be located in the main supply line, as in Figure Q–1 or at the head of each branch line, as in Figure Q–2 or at each location where fuel-gas is withdrawn, as in Figure Q–3. Where branch lines are of 2-inch pipe size or larger or of substantial length, protective equipment (designated as P_F) shall be located as shown in either Q–2 and Q–3.

(ii) Backflow protection shall be provided by an approved device that will prevent oxygen from flowing into the fuel-gas system or fuel from flowing into the oxygen system (see S_F, Figs. Q–1 and Q–2).

(iii) Flash-back protection shall be provided by an approved device that will prevent flame from passing into the fuel-gas system.

(iv) Back-pressure protection shall be provided by an approved pressure-relief device set at a pressure not greater than the pressure rating of the backflow or the flashback protection device, whichever is lower. The pressure-relief device shall be located on the downstream side of the backflow and flashback protection devices. The vent from the pressure-relief device shall be at least as large as the relief device inlet and shall be installed without low points that may collect moisture. If low points are unavoidable, drip pots with drains closed with screw plugs or caps shall be installed at the low points. The vent terminus shall not endanger personnel or property through gas discharge; shall be located away from ignition sources; and shall terminate in a hood or bend.

(c) If pipeline protective equipment incorporates a liquid, the liquid level shall be maintained, and a suitable antifreeze may be used to prevent freezing.

(d) Fuel gas for use with equipment not requiring oxygen shall be withdrawn upstream of the piping protective devices.

(iv) Station outlet protective equipment.

(a) A check valve, pressure regulator, hydraulic seal, or combination of these devices shall be provided at each station outlet, including those on portable headers, to prevent backflow, as shown in Figures Q–1, Q–2, and Q–3 and designated as S_F and S_O.

(b) When approved pipeline protective equipment (designated P_F) is located at the station outlet as in Figure Q–3, no additional check valve, pressure regulator, or hydraulic seal is required.

(c) A shutoff valve (designated V_F and V_O) shall be installed at each station outlet and shall be located on the upstream side of other station outlet equipment.

(d) If the station outlet is equipped with a detachable regulator, the outlet shall terminate in a union connection that complies with the Regulator Connection Standards, 1958, Compressed Gas Association.

(e) If the station outlet is connected directly to a hose, the outlet shall terminate in a union connection complying with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

(f) Station outlets may terminate in pipe threads to which permanent connections are to be made, such as to a machine.

(g) Station outlets shall be equipped with a detachable outlet seal cap secured in place. This cap shall be used to seal the outlet except when a hose, a regulator, or piping is attached.

(h) Where station outlets are equipped with approved backflow and flashback protective devices, as many as four torches may be supplied from one station outlet through rigid piping, provided each outlet from such piping is equipped with a shutoff valve and provided the fuel-gas capacity of any one torch does not exceed 15 cubic feet per hour.

This subdivision does not apply to machines.

(v) Hose and hose connections.

(a) Hose for oxy-fuel gas service shall comply with the Specification for Rubber Welding Hose, 1958, Compressed Gas Association and Rubber Manufacturers Association.

(b) The generally recognized colors are red for acetylene and other fuel-gas hose, green for oxygen hose, and black for inert-gas and air hose.

(c) When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches out of 12 inches shall be covered by tape.

(d) Hose connections shall comply with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.

(e) Hose connections shall be clamped or otherwise securely fastened in a manner that will withstand, without leakage, twice the pressure to which they are normally subjected in service, but in no case less than a pressure of 300 p.s.i. Oil-free air or an oil-free inert gas shall be used for the test.

(f) Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall be repaired or replaced.

(vi) Pressure-reducing regulators.

(a) Pressure-reducing regulators shall be used only for the gas and pressures for which they are intended. The regulator inlet connections shall comply with Regulator Connection Standards, 1958, Compressed Gas Association.

(b) When regulators or parts of regulators, including gages, need repair, the work shall be performed by skilled mechanics who have been properly instructed.

(c) Gages on oxygen regulators shall be marked "USE NO OIL."

(d) Union nuts and connections on regulators shall be inspected before use to detect faulty seats which may cause leakage of gas when the regulators are attached to the cylinder valves. Damaged nuts or connections shall be destroyed.

(6) Acetylene generators.

(i) Approval and marking.

(a) Generators shall be of approved construction and shall be plainly marked with the maximum rate of acetylene in cubic feet per hour for which they are designed; the weight and size of carbide necessary for a single charge; the manufacturer's name and address; and the name or number of the type of generator.

(b) Carbide shall be of the size marked on the generator nameplate.

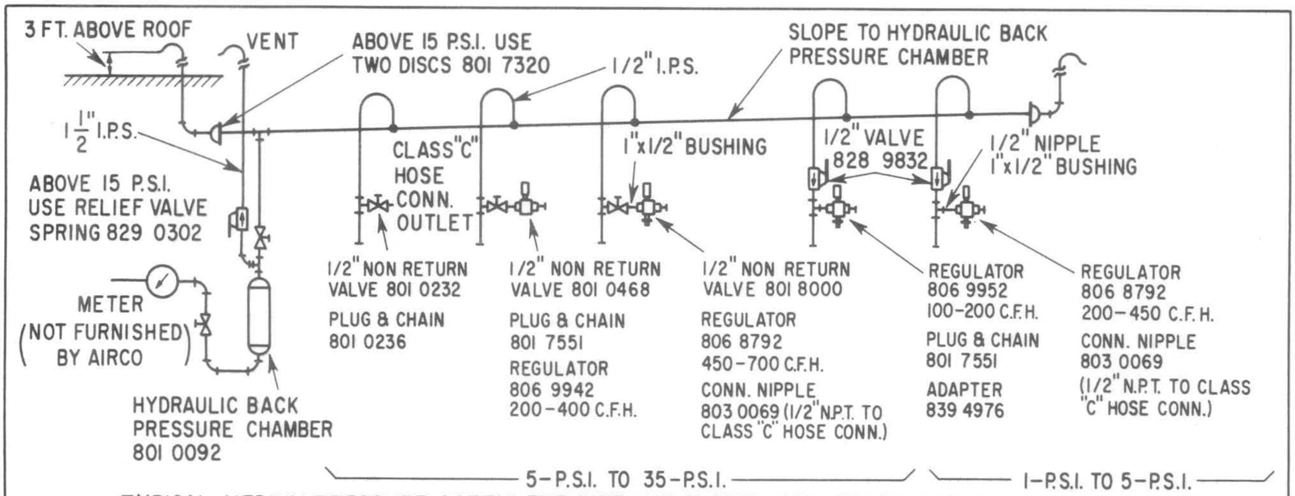
(ii) Rating and pressure limitations.

(a) The total hourly output of a generator shall not exceed the rate for which it is approved and marked. Unless specifically approved for higher ratings, carbide-feed generators shall be rated at 1 cubic foot per hour per pound of carbide required for a single complete charge.

CONVERTING TO OTHER FUELS AND INSTALLATION REQUIREMENTS:

Many users of acetylene as a fuel gas for cutting are converting their acetylene distribution systems to use other fuels.

MEDIUM PRESSURE SYSTEM: Presently many fuel gas systems are designed for use with medium pressure acetylene. With operating conditions at an optimum, some of these systems may be made to function properly with other fuels. However, the majority of the gas supply systems will not have adequate capacity to handle the flow and should be replaced. Conversion of a medium pressure acetylene system to any other fuel is shown in Fig. B-16.


3 FT. ABOVE ROOF
VENT
ABOVE 15 P.S.I. USE TWO DISCS 801 7320
1/2" I.P.S.
SLOPE TO HYDRAULIC BACK PRESSURE CHAMBER
1 1/2" I.P.S.
ABOVE 15 P.S.I. USE RELIEF VALVE SPRING 829 0302
CLASS "C" HOSE CONN. OUTLET
1"x1/2" BUSHING
1/2" VALVE 828 9832
1/2" NIPPLE 1"x1/2" BUSHING
METER (NOT FURNISHED BY AIRCO)
HYDRAULIC BACK PRESSURE CHAMBER 801 0092
1/2" NON RETURN VALVE 801 0232
PLUG & CHAIN 801 0236
1/2" NON RETURN VALVE 801 0468
PLUG & CHAIN 801 7551
REGULATOR 806 9942 200-400 C.F.H.
1/2" NON RETURN VALVE 801 8000
REGULATOR 806 8792 450-700 C.F.H.
CONN. NIPPLE 803 0069 (1/2" N.P.T. TO CLASS "C" HOSE CONN.)
REGULATOR 806 9952 100-200 C.F.H.
PLUG & CHAIN 801 7551
ADAPTER 839 4976
REGULATOR 806 8792 200-450 C.F.H.
CONN. NIPPLE 803 0069 (1/2" N.P.T. TO CLASS "C" HOSE CONN.)
5-P.S.I. TO 35-P.S.I.
1-P.S.I. TO 5-P.S.I.

TYPICAL MEDIUM PRESSURE ACETYLENE PIPELINE SYSTEM CONVERTED TO NATURAL GAS SERVICE

Figure B-16.

LOW PRESSURE SYSTEM: If only low pressure natural gas is available, it may be necessary to install a booster compressor upstream from the water seal so that the system will handle the gas flow requirements adequately. A conversion to a system that will handle low pressure natural gas is shown in Fig. B-17. It should always be remembered that a low pressure natural gas system has its limitations in that, regardless of the equipment used, the volume of fuel gas that can be fed through the pipeline, hose line and cutting equipment is limited by the available gas pressure. If the customer does not want to use a booster pump, and the pipeline inside diameter is too restrictive to the low pressure flow, then a new pipeline of a larger diameter must be installed.

For the best overall performance, the natural gas pressure should be at least 15 p.s.i., though it should not be necessary to exceed the maximum pressure limit of 35 p.s.i. set by Airco's Medium Pressure Hydraulic Back Pressure Chambers.

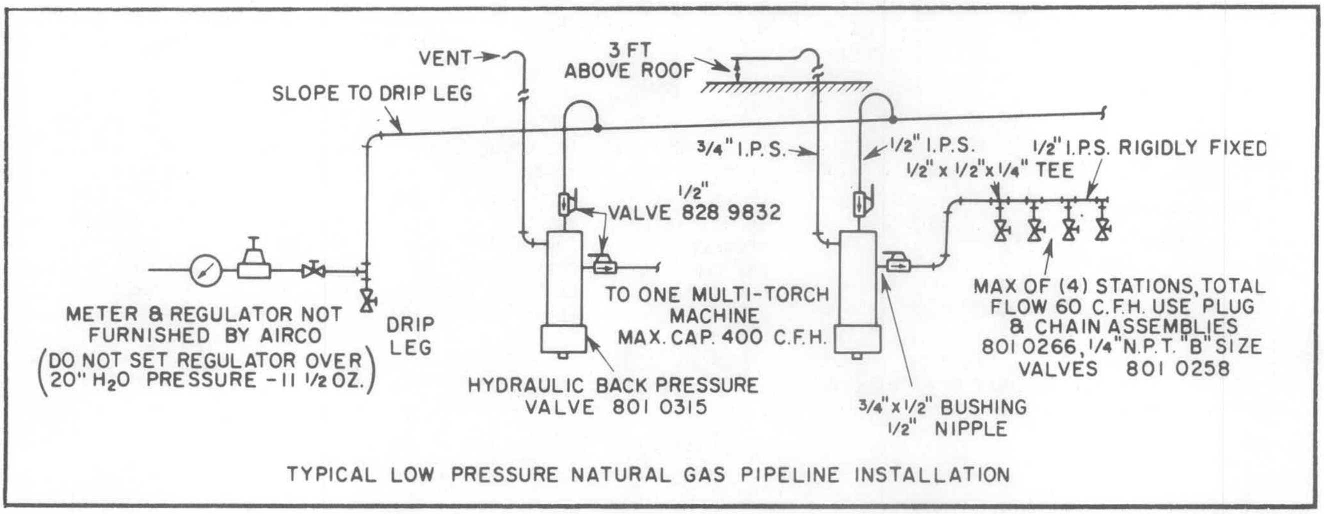

VENT
3 FT ABOVE ROOF
SLOPE TO DRIP LEG
3/4" I.P.S.
1/2" I.P.S.
1/2" I.P.S. RIGIDLY FIXED
1/2" x 1/2" x 1/4" TEE
1/2" VALVE 828 9832
TO ONE MULTI-TORCH MACHINE MAX. CAP. 400 C.F.H.
MAX OF (4) STATIONS, TOTAL FLOW 60 C.F.H. USE PLUG & CHAIN ASSEMBLIES 801 0266, 1/4" N.P.T. "B" SIZE VALVES 801 0258
METER & REGULATOR NOT FURNISHED BY AIRCO
(DO NOT SET REGULATOR OVER 20" H₂O PRESSURE - 11 1/2 OZ.)
DRIP LEG
HYDRAULIC BACK PRESSURE VALVE 801 0315
3/4" x 1/2" BUSHING 1/2" NIPPLE
TYPICAL LOW PRESSURE NATURAL GAS PIPELINE INSTALLATION

Figure B-17

INSTALLING A NEW NATURAL GAS SUPPLY SYSTEM: Where only low pressure natural gas (under 1 p.s.i.) is available, a system like the one in Figure B-17 can be installed provided it meets the ANSI Z49.1 requirements. Where medium pressure fuel gas is available a system like the one shown in Figure B-16 that also meets the ANSI Z49.1 requirements can be installed.

SIZING THE PIPELINE: For satisfactory performance of either a new or a converted system, the gas supply pipeline must be of adequate size to handle the gas flow requirements. In a system not properly sized, large pressure drops and pressure surges occur which downgrade performance of the cutting equipment and, in some cases, render it inoperable. Where conversion from a generated acetylene system is considered, the pipeline should be checked to make sure that lime deposits do not restrict gas flow by a reduction in diameter.

The following tables will be of help in determining if the pipeline is of adequate size. Since the tables are intended as a guide only, all conditions of pipe size and supply line pressure are not converted: note that Table B-6 is for 10 p.s.i. and more, and Table B-7 is for low pressure natural gas under 1 p.s.i.

TABLE B-6

MINIMUM PIPE SIZE FOR MEDIUM PRESSURE NATURAL GAS SERVICE
MORE THAN 10 PSI

Length of Pipeline in Feet

Flow CFH	100	200	300	400	500	600	700	800	900	1000	2000
100	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"
200	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
300	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"
400	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"
500	1/2"	3/4"	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1-1/4"
600	1/2"	3/4"	3/4"	1"	1"	1"	1"	1"	1"	1-1/4"	1-1/4"
700	3/4"	3/4"	3/4"	1"	1"	1"	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"
800	3/4"	3/4"	1"	1"	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"
900	3/4"	3/4"	1"	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"
1000	3/4"	1"	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/2"
1500	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
2000	1"	1-1/4"	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"

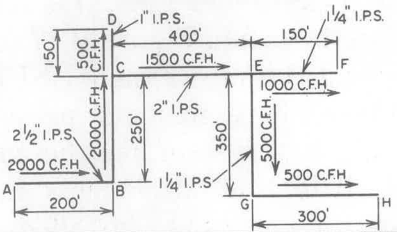
CALCULATIONS: A method of calculation which can be readily applied when determining the correct pipeline sizes for a proposed system is shown in Figure 18, which illustrates a typical medium pressure installation.

In calculating the required pipeline sizes, each terminating point in the illustrated system (D, F and H) is first considered as an individual installation running back to the gas source (A). By totaling footage for each of these hypothetical installations (A-D, A-F, and A-H) and considering their respective C.F.H. flows (500, 1000 and 1500, proper pipe size for each of the terminating sections (C-D, E-F, and E-G-H) can be taken from the table.

If each of the hypothetical installations stood alone, the pipeline sizes from the table for each installation would apply throughout the entire installation. However, since this is actually a complex installation, the pipeline size required to feed the fuel gas to the three terminating sections must be determined.

Where two terminating sections (for example E-F and E-G-H) have parallel feed lines (in this case A-E) these parallel lines are combined for reasons of economy into one line with a pipeline cross-sectional area equivalent to the sums of the areas of the two parallel lines replaced. The diameter of the new single line equals the square root of the sum of the squares of the diameters of the two individual lines. By calculation it is found that the required size for a common feed pipeline lies, in this case, between 1¾ in. and 2 in.

EXAMPLE: IF NATURAL GAS IS USED & PRESSURE IS 10 P.S.I.
DETERMINE SIZES OF PIPE THAT SHOULD BE
USED IN FOLLOWING SYSTEM.
(APPROXIMATE METHOD)



PIPELINE SECTION	REF. LENGTH	REF. FLOW	SIZE FROM CHART
A—H	200+250+400+350+300=1500 FT.	500 C.F.H.	$1\frac{1}{4}$"
A—F	200+250+400+150 = 1000 FT.	1000 C.F.H.	$1\frac{1}{4}$"
A—E		1500 C.F.H.	$\sqrt{1\frac{1}{4}^2+1\frac{1}{4}^2}=1\frac{3}{4}$" OR 2"
A—D	200+250+150 = 600 FT.	500 C.F.H.	1"
A—B—C		2000 C.F.H.	$\sqrt{1^2+2^2}=2\frac{1}{4}$" OR $2\frac{1}{2}$"

Figure B-18

For the best results, the 2 in. pipe would be used.

There is still another terminating section (C-D) that must be considered in the installation shown in Figure B-18. Since the feed line of C-D (A-B-C) is parallel to a portion of the line feeding the other two terminating sections (E-F and E-G-H), a common line sufficient to handle the flow to all three terminiating points must be established at B-B-C. Using the size determined for the common pipeline to feed both terminating sections E-F and E-G-H (2 in.) and the pipeline size that would be required to feed terminating section C-D alone (1 in.), the required pipeline size for section A-B-D (2½ in.) is determined with the same equation employed in the preceding paragraph.

TABLE B-7

MINIMUM PIPE SIZE FOR LOW PRESSURE NATURAL GAS SERVICE LESS THAN 1 PSI

Flow	Length of Pipeline in Feet										
CFH	100	200	300	400	500	600	700	800	900	1000	2000
100	3/4"	3/4"	3/4"	1"	1"	1"	1"	1"	1-1/4"	1-1/4"	1-1/4"
200	1"	1"	1"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/2"	1-1/2"	2"
300	1-1/4"	1-1/4"	1-1/4"	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"
400	1-1/4"	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"	2-1/2"
500	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2-1/2"	2-1/2"	3"
600	1-1/4"	1-1/2"	2"	2"	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	3"
700	1-1/2"	2"	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	3"	3"
800	1-1/2"	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	3"	3"	3"
900	1-1/2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	3"	3"	3"	3-1/2"
1000	2"	2"	2-1/2"	2-1/2"	2-1/2"	3"	3"	3"	3"	3"	3-1/2"
1500	2"	2-1/2"	3"	3"	3"	3"	3"	3"	3-1/2"	3-1/2"	4"
2000	2-1/2"	3"	3"	3"	3-1/2"	3-1/2"	3-1/2"	3-1/2"	4"	4"	5"

7. PIPELINE ACCESSORIES

Hydraulic Flashback Arrester

The Airco Hydraulic Flashback Arrester Fig. B-19 is a safety device for use in acetylene as well as in other fuel gas medium-pressure piping systems. When installed in the line between the source of supply and the point of consumption, it localizes disturbances to that section of the system downstream of the hydraulic arrester in which the disturbance begins. It therefore protects fuel gas piping against excessive pressure rises. Arresters are available for three pipeline diameters (1, 1-1/2 and 2), and for all commonly used fuel gases. They may be linked together in parallel to increase flow rates.

A spring-loaded relief valve in the assembly protects both the arrester and the piping against any excessive rise in pressure. The discharge vent pipe from this relief valve should leak to the outside atmosphere, through a wall or roof, in accordance with recommended practice.

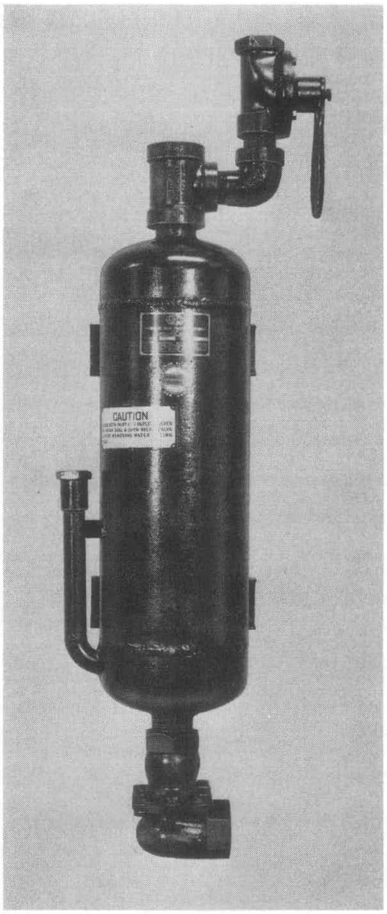


Figure B-19

HYDRAULIC FLASHBACK ARRESTER SPECIFICATIONS

Inlet & Outlet Connections	For Acetylene Only	For Other Fuel Gases	Peak Flow C.F.H.	Relief Valve Releases At	Relief Valve Stock Number	Relief Valve Outlet	Water Capacity	Weight (Crated)
1"	801 0091		1000 @ 12 Psig	15.5-20 Psig	829 0169	1-1/2"		
for 3/4 to 1" lines		801 0101	1500 @ 25 Psig	35-45 Psig	829 0296	1-1/2"	2-1/2 Qts.	102 Lbs.
2"	801 0092		3600 @ 12 Psig	15.5-20 Psig	829 0169	1-1/2"		
for 1½ to 2" lines		801 0102	5000 @ 25 Psig	35-45 Psig	829 0296	1-1/2"	10 Qts.	196 Lbs.

***Pressure Above 35 Psig is not recommended as double acting check valve will stop flow.**

STATION VALVES

Station valves (Fig. B-20) are used to control gas and some liquid flows, are designed to meet the need for a non-return type shut-off valve for station drops in a piping system. They reverse flows in pipe-line system. NOT RECOMMENDED FOR FUEL SERVICE LESS THAN 5 p.s.i.

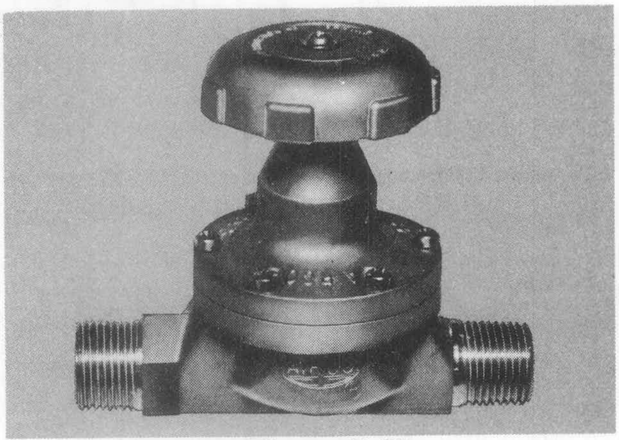


Figure B-20

1/2 INCH DIRECT CONNECTION TO STATION REGULATORS OR HOSE

Stock No.	Drawing	Gas Service	Inlet Thread	Outlet Thread	Rating[1] (psi)	Plug and Chain Assy.[2]
801-0469	A	Oxygen	1/2" NPT Ext.	.903-14 RH Ext.	250	801-7547
801-0468	A	Acetylene	1/2" NPT Ext.	.825-14 LH Ext.	15	801-7551
801-0468	A	Fuel gas	1/2" NPT Ext.	.825-14 LH Ext.	50	801-7551
801-0170	A	Nitrogen OP	1/2" NPT Ext.	.903-14 LH Ext.	250	801-5002
801-0233 *	A	Oxygen	1/2" NPT Ext.	7/8-14, "C" Hose RH Ext.	250	801-0237
801-0232 *	A	Acetylene	1/2" NPT	7/8-14, "C" Hose LH Ext.	15	801-0236
801-0232 *	A	Fuel gas	1/2" NPT	7/8-14, "C" Hose LH Ext.	50	801-0236
801-0600	A	MAPP® Gas-Prop.	1/2" NPT Ext.	.825-14 LH Ext.	250	801-7551
801-0601 *	A	MAPP® Gas-Prop.	1/2" NPT Ext.	7/8-14, "C" Hose LH Ext.	250	801-0236

Stock No.	Drawing	Gas Service	Inlet Thread	Outlet Thread	Rating[1] (psi)	"B" Size Hose Connection	"C" Size Hose Connection
801-0469	A	Oxygen	1/2" NPT Ext.	.903-14 RH Ext.	250	.839-0077 9/16-18, RH	.839-0078 7/8-14, RH
801-0468	A	Acetylene	1/2" NPT Ext.	.825-14 LH Ext.	15	.839-0079 9/16-18, LH	.839-0080 7/8-14, LH
801-0468	A	Fuel gas	1/2" NPT Ext.	.825-14 LH Ext.	50	.839-0079 9/16-18, LH	.839-0080 7/8-14, LH
801-0170	A	Nitrogen OP	1/2" NPT Ext.	.903-14 LH Ext.	250	.839-0113 9/16-18, LH	.839-0114 7/8-14, LH
801-0233 *	A	Oxygen	1/2" NPT Ext.	7/8-14, "C" Hose RH Ext.	250	.801-0237	None required
801-0232 *	A	Acetylene	1/2" NPT Ext.	7/8-14, "C" Hose LH Ext.	15	.801-0236	None required
801-0232 *	A	Fuel gas	1/2" NPT Ext.	7/8-14, "C" Hose LH Ext.	50	.801-0236	None required
801-0600	A	MAPP-Propane	1/2" NPT Ext.	.825-14 LH Ext.	250	.839-0079 9/16-18, LH	.839-0080 7/8-14, LH
801-0601 *	A	MAPP-Propane	1/2" NPT Ext.	7/8-14, "C" Hose LH Ext.	250	.801-0236	None required
1 INCH FOR ADAPTING TO HOSE CONNECTION							
801-0171	B	Oxygen	1" NPT Int.	1" NPT Int.	250	801-0108 1-1/4-12 RH 839-0096 Adapter	801-0104 1-7/8-12 RH 839-0092 Adapter
801-0171	B	Acetylene	1" NPT Int.	1" NPT Int.	15	801-0109 1-1/4-12 LH 839-0099 Adapter	801-0105 1-7/8-12 LH 839-0093 Adapter
801-0171	B	Fuel gas	1" NPT Int.	1" NPT Int.	50	801-0109 1-1/4-12 LH 839-0099 Adapter	801-0105 1-7/8-12 LH 839-0093 Adapter
801-0171	B	Nitrogen OP	1" NPT Int.	1" NPT Int.	250	839-0109 1-1/4-12 LH 839-0099 Adapter	801-0105 1-7/8 LH 839-0093 Adapter

1/2 INCH FOR DIRECT CONNECTION TO 1/2 INCH PIPE

801-8000	A	General non-corrosive	1/2" NPT Ext.	1/2" NPT Ext.	250	–	–
801-8000	A	Acetylene	1/2" NPT Ext.	1/2" NPT Ext.	15	–	–

COMBINATION STATION AND CHECK VALVE NON-RETURN TYPE

Airco combination station and check valves are non-return type shut-off valves which contain a removable filter. Gases flow through this filter, past the check valve and then to the shut-off valve.

Valves can be used with all hand torches, single or two torch operation, on small cutting machines.

These valves are designed to meet the need for a non-return type shut-off valve for station drops and risers in a gas piping system. Recommended for low pressure fuel gas systems or fuel systems up to 150 psi (valve 801-0360) and oxygen gas systems up to 150 psi (valve 801-0460).

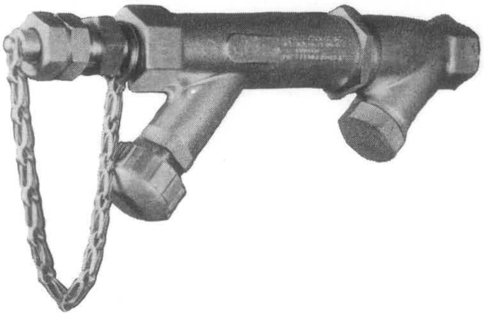


Figure B-21

Stock No.	Gas Service	Inlet Threads	Outlet Threads	PSI Rating	Plug & Chain
801-0360	Fuel	1/4 NPT Int.	B 9/16-18 LH	150*	801-0364
801-0360	Natural gas	1/4 NPT Int.	B 9/16-18 LH	150	801-0364
801-0460	Oxygen	1/4 NPT Int.	B 9/16-18 RH	150	801-0361

* Note: Do not use Acetylene over 15 psi

STATION-OUTLET AND FLOW-CONTROL VALVES

Small station-outlet and flow-control valves are required in a number of industrial applications. Among these applications are the gas shielded-arc welding processes. When these processes are used in production lines, multiple work stations are fed from a main distribution system at controlled pressure. Each work station may be fitted with a station-outlet valve to which a flow-meter is attached, or the flow can be metered through a flow-control valve.

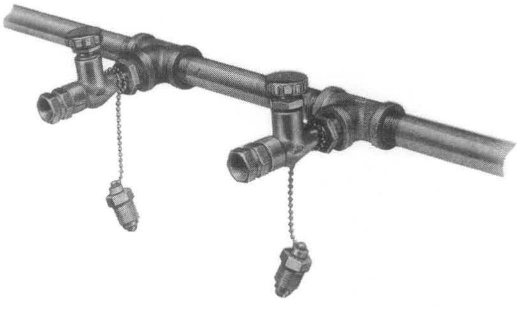


Figure B-22

Although the Airco Station-Outlet and Flow-Control Valves are similar in outward appearance, they differ in internal operation. The Station-Outlet Valve has a ball-type stem for high gas flows, while the Flow-Control Valve has a needle-type stem.

Stock No.	Gas Service	Inlet Thread	Out-let Thread	Rat-ing (psi)	Plug & Chain (to cap valve)
FLOW CONTROL VALVE ("B" SIZE NEEDLE-TYPE STEM ASSEMBLY)[2]					
801-0261	Oxygen	1/4 NPT Ext.	9/16-18 RH Ext.	250	801-0265
801-0262	Fuel gas	1/4 NPT Ext.	9/16-18 LH Ext.	250	801-0266
801-0263	Inert Gas	1/4 NPT Ext.	5/8-18 RH Int.	250	801-0267
801-0264	Air & Water	1/4 NPT Ext.	5/8-18 LH Int.	250	801-0268
STATION-OUTLET VALVE ("B" SIZE BALL-TYPE STEM ASSEMBLY)[1]					
801-0257	Oxygen	1/4 NPT Ext.	9/16-18 RH Ext.	250	801-0265
801-0258	Fuel Gas	1/4 NPT Ext.	9/16-18 LH Ext.	250	801-0266
801-0259	Inert Gas	1/4 NPT Ext.	5/8-18 RH Int.	250	801-0267
801-0260	Air & Water	1/4 NPT Ext.	1/4 NPT LH Int.	250	801-0268
801-0281	General	1/4 NPT Ext.	1/4 NPT Int.	250	

[1] Stock Number of Ball-Type Stem Assy. is 831-2124.
[2] Stock Number of Needle-Type Stem Assy. is 831-2239

BURSTING DISC

The Airco Bursting Disc (Fig. B-23) is installed mostly in fuel distribution piping systems to protect the piping from damage caused by excessive pressures such as an internal explosion. To function properly, the assembly must be installed in the systems pipeline so that it will be in the direct path of any explosive wave usually on the end of a long straightaway. It must also direct any resulting flame to the atmosphere without coming in contact with any flammable material.

The assembly consists of a steel bursting disc chamber and a metallic bursting disc. Minimun inside diameter of the chamber is four inches for a length of six inches. The metallic bursting disc is located next to and upstream from the chamber. It is placed between two companion flanges so that it has a minimum free diameter of four inches. The disc is designed for a rupture pressure of not less than 50 psi nor more than 70 psi.

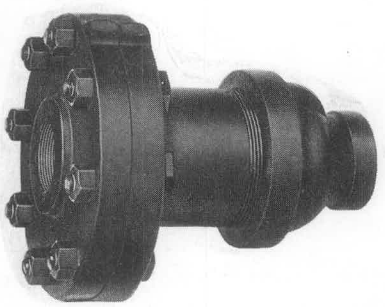
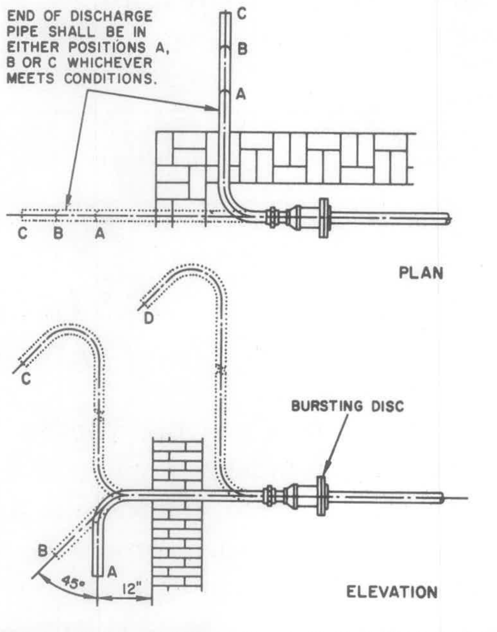


Figure B-23

In the piping layout diagram shown below (Fig. B-24), information is provided on various venting arrangements. For further protection of the piping system, the user should also install a hydraulic flashback arrester.

HOW TO ORDER

Description	Stock Number
Bursting disc assembly	801-7320
Metallic bursting disc	836-7487


END OF DISCHARGE PIPE SHALL BE IN EITHER POSITIONS A, B OR C WHICHEVER MEETS CONDITIONS.
C
B
A
C B A
PLAN
D
C
BURSTING DISC
B
45°
A
12"
ELEVATION

POSITION A — SHOULD BE USED IF WALL IS THOROUGHLY FIREPROOF AND LINE IS OF SUFFICIENT HEIGHT ABOVE GROUND.

POSITION B — SHOULD BE USED WHERE WALL IS NONFIREPROOF AND LINE IS OF SUFFICIENT HEIGHT ABOVE GROUND.

POSITION C — SHOULD BE USED WHEN LINE IS NOT OF SUFFICIENT HEIGHT ABOVE GROUND TO PERMIT USING POSITION A OR B.

POSITION D — SHOULD BE USED WHERE THE BURSTING DISC IS ON END OF LINE TERMINATING INSIDE OF BUILDING TOO FAR FROM AN OUTSIDE WALL TO PERMIT FURTHER EXTENSION OF THE LINE.
THE HORIZONTAL END OF THE DISCHARGE PIPE CAN BE TURNED IN ANY POSITION MOST SUITABLE TO MEET CONDITIONS AND OUTLET NOT LESS THAN 3'-6" FROM ROOF.

CAUTION — IN ALL CASES, THE DISCHARGE PIPE MUST BE INSTALLED IN SUCH A POSITION THAT, WHEN FUNCTIONING, THERE CAN BE NO PERSONAL INJURY TO PEDESTRIAN OR VEHICULAR TRAFFIC ON ADJACENT PRIVAT PROPERTY, DRIVEWAY, OR PUBLIC THOROUGHFARE AND NO FIRE HAZARD WILL BE CREATED THAT IS DANGEROUS TO SURROUNDING BUILDINGS OR OTHER PROPERTY.

LESSON PLAN

SUBJECT: SECTION C: GAS REGULATORS

OBJECTIVE: To have the participant understand the functions of gas regulators including the single-stage and two-stage regulators, and their performance terms.

REFERENCES: Product Information Class 8 Text, Section C: — Gas Regulators

TRAINING MATERIALS: Section C: Gas Regulators

Slides C-1 through C-16

Projector

Projection Screen

Oxygen Pressure Regulator

Applied Exercise

PRESENTATION:

I. GAS REGULATORS

A. Function — you remember that gases are stored in cylinders under pressure. In the case of acetylene the pressure is 250 p.s.i. at 70°F. Oxygen is under 2200 p.s.i. at 70°F. The maximum allowable pressure for working with acetylene is 15 p.s.i. — that's *maximum.* Oxygen is generally used at working pressures up to 100 p.s.i. So whatever the gas, its stored pressure. must be reduced to its working pressure. The device that reduces cylinder pressure to working pressure is called a gas regulator.

There are two output considerations, the one we have already mentioned, working pressure; the second is the rate of *gas flow,* usually measured in cubic feet per hour (cfh).

Slide C-1 OXYGEN PRESSURE REGULATOR. THE ACTUAL PRODUCT COULD BE SHOWN IF AVAILABLE.

B. The general appearance of the regulator is the same whether it is used for oxygen, acetylene, hydrogen, or any other gas. *BUT THERE ARE DIFFERENCES.* You know that gases are stored under pressure and that the working pressure used depends upon the nature of the gas. The regulator must be selected to regulate a *specific* gas.

C. High Pressure Gauge
   1. Registers cylinders pressure 0-4000 p.s.i.

D. Low Pressure Gauge
   1. Registers working pressure 0-200 p.s.i.

E. Adjusting screw sets working pressure.

F. The hose fitting on oxygen regulators has a right-hand thread. A fuel gas regulator hose fitting has a left-hand thread.

Slide C-2 TABLE SHOWS RELATIONSHIP AMONG THE PRESSURES AND GAUGES.

G. Gauges have a wider range than intended maximum pressure. Illustration shows various pressures and gauges.

II. SINGLE AND TWO-STAGE REGULATORS

A. Single-Stage — high cylinder pressure is reduced to usable pressure in one step, or stage.

B. Two-Stage — high cylinder pressure is reduced first to a lower and fixed value of pressure, then to the usable pressure.

Slide C-3 CROSS SECTION OF SINGLE STAGE REGULATOR DIRECT SEAT

C. Single-Stage—
  1. Direct Seat—working pressure falls off as cylinder pressure falls due to withdrawal of gas.

Slide C-4 INVERSE SEAT

  2. Inverse seat—opposite—working pressure will slowly rise as cylinder pressure falls.

Slide C-5 A GRAPH SHOWS CURVE WHEN USING DIRECT AND INVERSE SEAT.

  3. A chart showing working pressure and cylinder pressure when using direct or inverse seat.
  4. After use, close cylinder valve first, relieve pressure downstream, then back off the adjusting screw to close the seat mechanism. This relieves the tension on parts.

Slide C-6 CROSS SECTION OF SINGLE-STAGE REGULATOR INVERSE SEAT

D. How a Single-Stage Regulator Works
  1. Parts
    a. Adjusting Screw
    b. Coil spring
    c. Diaphragm
    d. Stem
    e. Inverse valve seat
    f. Marginal spring

Slide C-7 SINGLE-STAGE REGULATOR TIGHTENING SCREW UNSEATS VALVE

  2. Function
    a. Open cylinder valve slowly admitting high pressure gas.
    b. Turning the adjusting screw tightens the coil spring and unseats the valve.
      (1) Further turning of the adjusting screw tightens the spring and pushes against the diaphragm.
    c. Valve unseated, gas flows from cylinder through nozzle into regulator chamber.

Slide C-8 SINGLE-STAGE REGULATOR GAS PUSHES AGAINST DIAPHRAGM.

d. Opposing forces — gas pressure versus spring pressure try to reach exact balance.

Slide C-9 SINGLE-STAGE REGULATOR GAS FLOWS THROUGH REGULATOR

e. Gas flows through regulator.
   (1) Gas constantly flowing through outlet to hose or pipe, forces cannot reach balance.
   (2) More gas rushes into regulator.

Slide C-10 SINGLE-STAGE REGULATOR SHUT OFF AT DELIVERY END

f. No flow out.
   (1) Off at delivery end.
   (2) Gas pressure builds up against spring.
   (3) Inlet valve closes activated by marginal spring.

Slide C-11 SINGLE-STAGE REGULATOR SPRING AUTOMATICALLY COMPENSATES FOR DECREASING CYLINDER PRESSURE IN USE.

g. Cylinder pressure decreases.
   (1) As cylinder is emptied, cylinder pressure decreases.
   (2) Spring pressure automatically compensates by opening the valve seat wider and wider as the inlet pressure against it becomes less and less.

Slide C-12 OF FIGURE C-9 RISING CURVE OF SINGLE-STAGE REGULATOR INVERSE SEAT

h. Performance Curve Single-Stage Regulator
   (1) Because of extreme drop from inlet pressure to working pressure, the outlet pressure changes and periodic readjustment is required to maintain delivery pressure.

E. Two-Stage Regulators

Slide C-13a CUT AWAY OF TWO-STAGE REGULATOR

1. Reduces the high inlet pressure to a fixed, intermediate, non-adjustable pressure in the first stage.
2. The second stage, is adjustable, where pressure is further reduced to the working pressure.

Slide C-13b CLOSE UP OF CUT AWAY OF TWO-STAGE REGULATOR

3. The Airco design two-stage regulator has one stage of direct regulation and one stage of inverse regulation.
   a. Delivers constant working pressure which eliminates need for adjustment.

Slide C-14 PARTS OF TWO-STAGE REGULATOR

F. How An Airco Two-Stage Regulator Works

1. Parts
   - a. First Stage—
     - (1) Inlet nozzle
     - (2) Valve seat-direct
     - (3) Lever
     - (4) Diaphragm
     - (5) Coil spring
     - (6) Leaf spring (marginal spring)
   - b. Second Stage—
     - (1) Adjusting screw
     - (2) Coil spring
     - (3) Diaphragm
     - (4) Stem
     - (5) Valve Seat—inverse
     - (6) Marginal spring
2. Function
   - a. First Stage—
     - (1) From cylinder, gas enters inlet nozzle and fills chamber. As pressure builds up, diaphragm and coil spring are pushed down and the direct valve seat closes actuated by the leaf spring (marginal spring)
     - (2) As pressure drops because of gas usage the direct seat opens wider, and the diaphragm and coil spring rise. The lever works like a seesaw.

Slide C-15 TWO-STAGE GAS ENTERS SECOND-STAGE

   - b. Gas Enters Second Stage—The moment the cylinder valve is opened, gas enters the first stage of the regulator. The second stage will work only when the adjusting screw is turned-in. As the screw is turned to the required delivery pressure, the second stage will work in the same manner as a single-stage regulator. The only difference is that the delivery pressure will remain constant throughout the entire

Slide C-16
PERFORMANCE CURVE AIRCO TWO-STAGE REGULATOR

withdrawal of the gas from the cylinder because the pressure exerted on the seat of the second-stage is constant.

III. PERFORMANCE TERMS

A. End-Point

1. A point where the regulator ceases to function because there is not enough pressure in the cylinder to make the regulator react.
   a. The end point (in p.s.i.) should be low. If it is high, there would be more gas left in the cylinder which a customer paid for but cannot use.
   b. An operator can detect that the end-point has been reached when there is a sudden outlet pressure increase and then a drop as observed on the gauge.

B. Static Increment

1. It is the amount of pressure rise shown on the delivery pressure gauge when the equipment is shut off. A poor regulator has a high static increment.

C. Creep

1. Is caused by a leak into the delivery side of the regulator and builds up pressure in the hose if the equipment is off. Example: If the amount of creep lasts long enough without being noticed the pressure in the hose can build up as high as cylinder pressure, if the hose did not burst first.
2. In the fuel regulator, the hose will be able to withstand the relatively low pressure. Therefore, there is no need for a safety relief valve on fuel regulators.
3. However, with a regulator handling high pressure gases, like oxygen and hydrogen, the hose will not be able to withstand the pressure of a full cylinder; therefore, this type of

regulator should have a safety relief valve, as do ALL Airco regulators—not so with some competitors.

4. In the less expensive regulator line, the safety device consists of a specially designed back-up plate behind the diaphragm which has holes and allows the diaphragm to burst serving the same function as the safety relief valve.

D. Seat Ignition
   1. When a cylinder is opened, the high pressure causes gas heating and compression which could deteriorate the valve seat if the cylinder valve is not opened slowly.

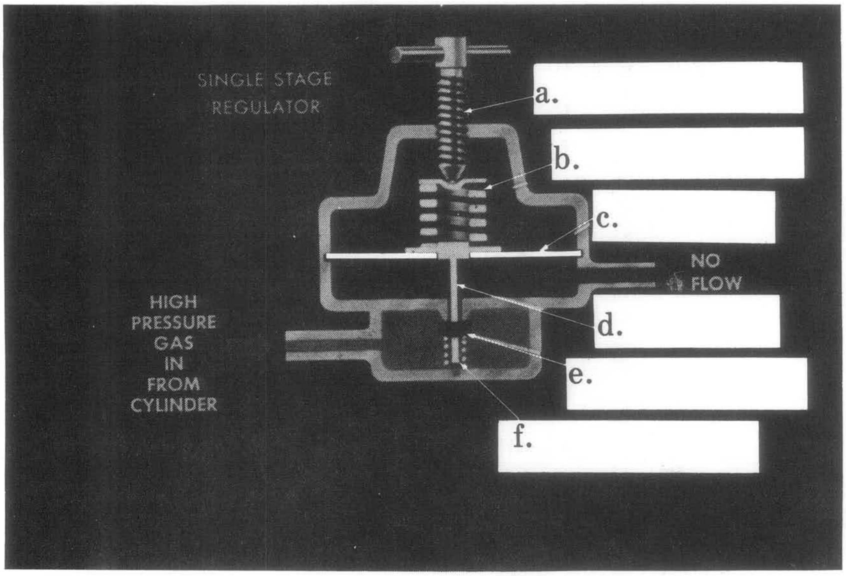
E. Safety Features
   1. If the high pressure gas entering the regulator goes directly to the seat, there is danger of ignition. This danger is reduced by a "dead-end passage" designed into Airco two-stage regulators.
      a. High pressure gas reaches the passage before it reaches the diaphragm. Similarly, Airco two-stage regulators are equipped with a safety device which reseats itself after high pressure has been relieved.
   2. Low pressure chamber has a safety relief valve in the event a cracked seal or creep causes leakage of high pressure gas into the low pressure chamber.
   3. In the event of rupture of the Bourdon tube, in the high pressure gauge, a flexible back plate, (blow out back) will release—avoiding breaking the gauge body and shattering its face.

APPLIED EXERCISE FOLLOWS:

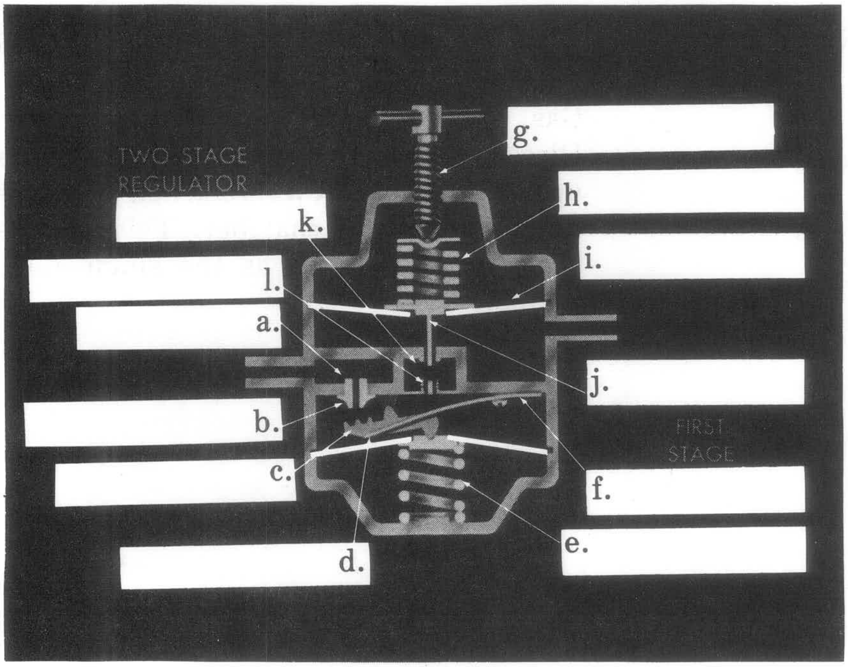
AFTER EACH PARTICIPANT HAS HAD SUFFICIENT TIME TO LABEL PARTS, ASK FOR VOLUNTEERS TO CALL OUT THE PARTS AND TO EXPLAIN HOW A SINGLE AND TWO-STAGE REGULATOR WORKS. SHOW SLIDES OF EACH.

APPLIED EXERCISE:

1. Below is a single-stage and an Airco two-stage regulator cross section. Identify the parts by name.



SINGLE-STAGE REGULATOR



TWO-STAGE REGULATOR

2. Explain how a single-stage regulator works.

3. Explain how a two-stage regulator works.

CHECK YOUR ANSWERS ON NEXT PAGE

ANSWERS TO APPLIED EXERCISE

1. SINGLE-STAGE REGULATOR PARTS:

   a. Adjusting Screw
   b. Coil Spring
   c. Diaphragm
   d. Stem
   e. Inverse valve seat
   f. Marginal spring

TWO-STAGE REGULATOR PARTS:

FIRST STAGE:

a. Inlet nozzle
b. Direct valve seat
c. Lever
d. Diaphragm
e. Coil spring
f. Leaf spring (marginal spring)

SECOND-STAGE:

g. Adjusting screw
h. Coil spring
i. Diaphragm
j. Stem
k. Inverse valve seat
l. Marginal spring

2. HOW A SINGLE-STAGE REGULATOR WORKS:

   Turn the adjusting screw.
   Tightens spring and unseats valve.
   Gas flows through.

3. HOW A TWO-STAGE REGULATOR WORKS:

   Gas from cylinder enters inlet nozzle. Direct valve seat closes as pressure builds up. Adjusting screw is turned and gas flows into second chamber. This second-stage acts the same as the single-stage regulator.

The delivery pressure is the pressure chosen to adjust the regulator in order to perform a particular operation. With direct seat mechanism, the set delivery pressure falls off as the cylinder pressure falls off. It necessitates that frequent pressure adjustment be made during the course of a long period of work.

With the inverse seat mechanism, the opposite effect happens, but with a substantially lower rate of change. As an example, with a regulator having an inverse seat mechanism, the set pressure will slowly rise as the high cylinder pressure deminishes. The need to make minor delivery pressure adjustments will be less than with a direct seat regulator for the same long period of work.

Figure C-2 shows an exaggerated graphic view of the effect on delivery pressures between a direct seat and inverse seat mechanism.

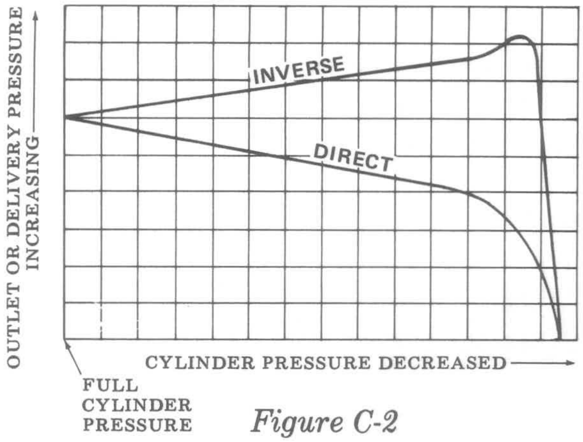


Figure C-2

The result is that few single-stage regulators with direct seat mechanism are in use.

However, in order to understand the operation of an Airco two-stage regulator which uses a combination of inverse and direct seat mechanism for maximum performance, it is important to know about direct seat.

2. HOW A SINGLE-STAGE REGULATOR WORKS:

As we look at Figure C-3 we see the diagram of a single-stage regulator consisting of — a coil spring, a diaphragm and a stem which extends through a narrow nozzle and enlarges to form a seat on the other side. A marginal spring on the upstream side holds the seat closed. We open the cylinder valve slowly, admitting high pressure gas to the inlet side of the regulator.

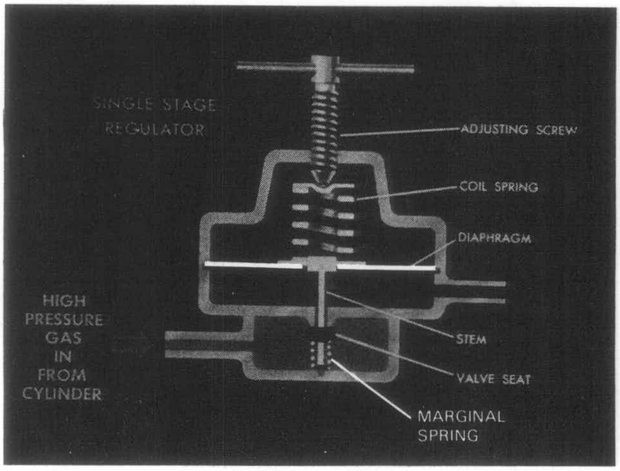


Figure C-3

Turning Adjusting Screw Tightens Spring and Unseats Valve: Now we turn the adjusting screw to tighten the spring pushing against the top of the diaphragm. This unseats the valve and allows gas from the cylinder to rush through the nozzle and into the regulator chamber.

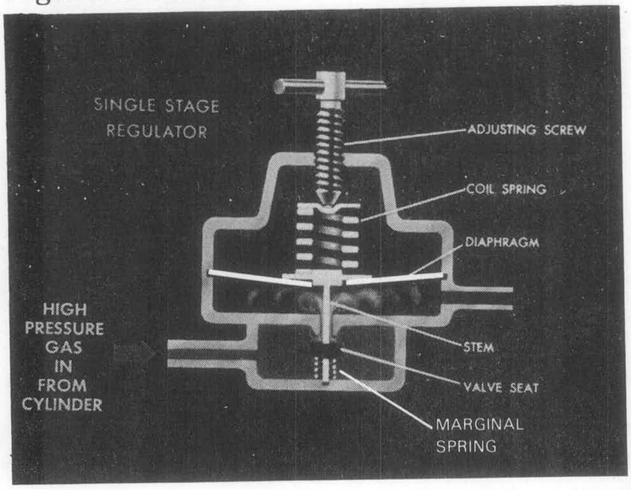


Figure C-4

Opposing Forces of Gas Pressure and Spring Pressure: The gas pushes against the diaphragm so that the opposing forces of spring load on top of the diaphragm and gas pressure on the bottom try to reach a balance.

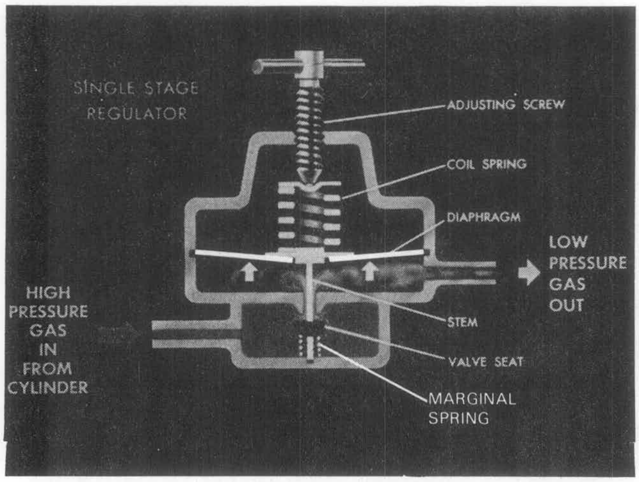


Figure C-5

Gas Flows Through Regulators: Before this occurs, the gas in the regulator chamber moves through the outlet, out of the regulator and through the hose or pipe at the required pressure. With this volume of gas constantly escaping, the opposing forces can't reach a balance. . .which would cause the valve to close. More high pressure gas rushes into the regulator chamber from the cylinder, escapes, and is replaced in the same way. Spring pressure adjustment determines the gas pressure and the size of the downstream opening determines the rate of gas flow.

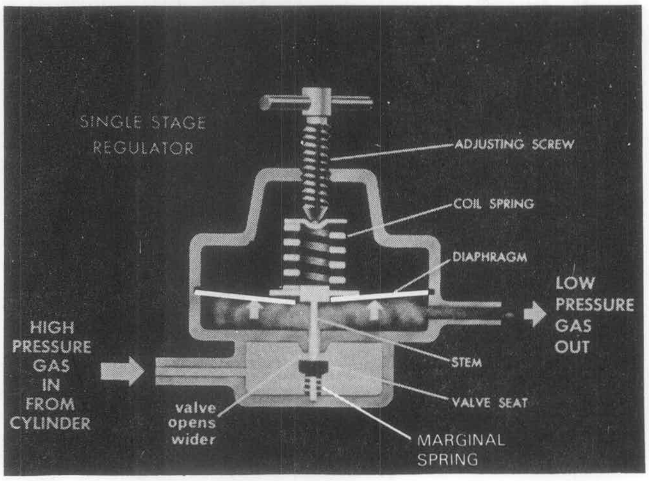


Figure C-6

Flow Turned Off, No Flow Out: If the flow is turned off at the delivery end, gas pressure builds up in the regulator against the diaphragm, forcing it back against the spring, allowing the inlet valve to close.

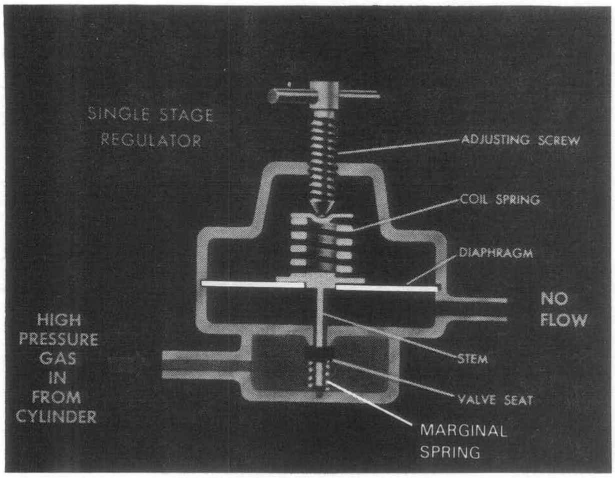


Figure C-7

Cylinder Pressure Decreases: In use, as the cylinder is emptied, cylinder pressure decreases. The spring pressure automatically compensates for this by opening the valve wider and wider as the inlet pressure against it decreases. In this way, the required outlet pressure is maintained.

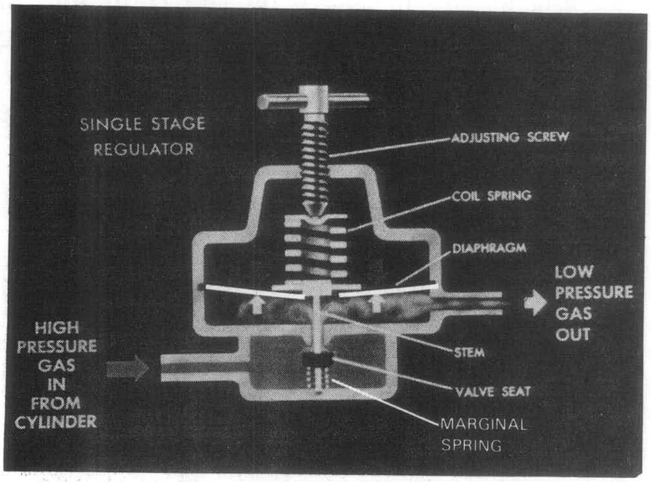


Figure C-8

Performance Curve-Single-Stage Regulator: Because of the extreme pressure drop, however, from thousands of pounds of inlet pressure to working pressures of generally less than 100 psi, some change in outlet pressure occurs with a single-stage regulator, and readjustment is required to maintain delivery pressure.

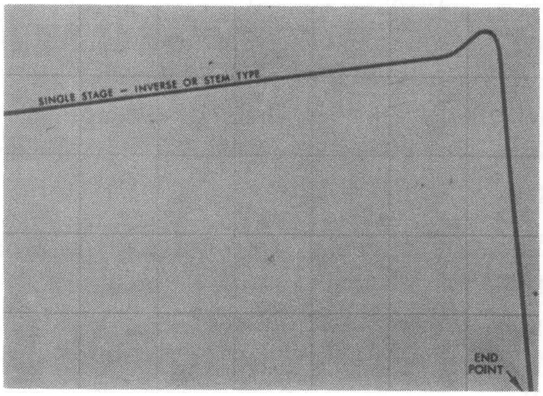


Figure C-9

3. TWO-STAGE REGULATORS:

The two-stage or dual-stage regulator reduces the high inlet pressure to a fixed, intermediate, and non-adjustable pressure in the first-stage. Then the gas is led to a second and adjustable stage where the pressure is further reduced to the value needed for use in the torch. Two-stage regulators, available for use with cylinders and manifolds, may have two-stages of direct regulation, two stages of inverse regulation, or one inverse and one direct. Airco is the only manufacturer that uses one stage of each kind. This gives the most constant control of pressure and flow.

The advantages of two-stage regulators is that the delivery pressure is controlled to close limits regardless of the gradual decrease of high pressure gas from the cylinder.

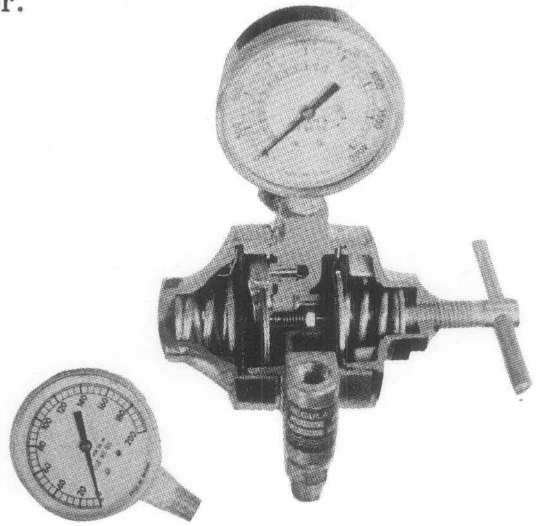


Figure C-10a

HOW AN AIRCO TWO-STAGE REGULATOR WORKS: The Airco design consists of one direct and one inverse seat design coupled together. The valve inside the first-stage consists of a factory-adjusted coil spring which holds down a diaphragm at one end of a flat lever. The lever works like a small see-saw. On the other end, the raised end, is the inlet valve seat which remains open when the regulator is not in operation. This end is controlled by a leaf spring which counters the stronger force of the coil spring.

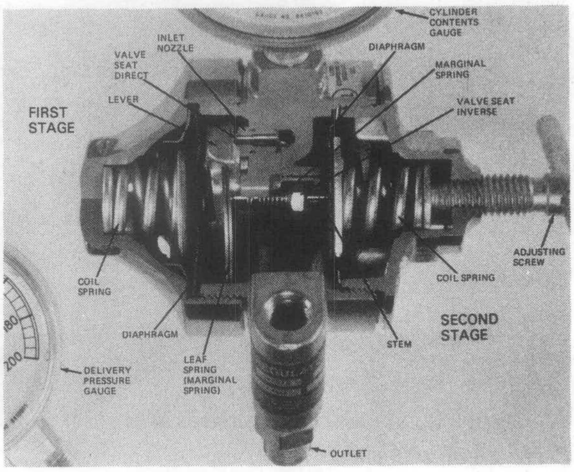


Figure C-10b

Gas Enters First Stage. Valve Seat Moves Toward Inlet Nozzle: When the cylinder valve is opened, gas enters and builds up pressure in the first stage chamber. The diaphragm is forced against the coil spring, releasing spring pressure on the right end of the see-saw lever. This allows the leaf spring to move the valve seat at the other end of the lever toward the inlet nozzle. The higher the inlet pressure, the more the valve closes.

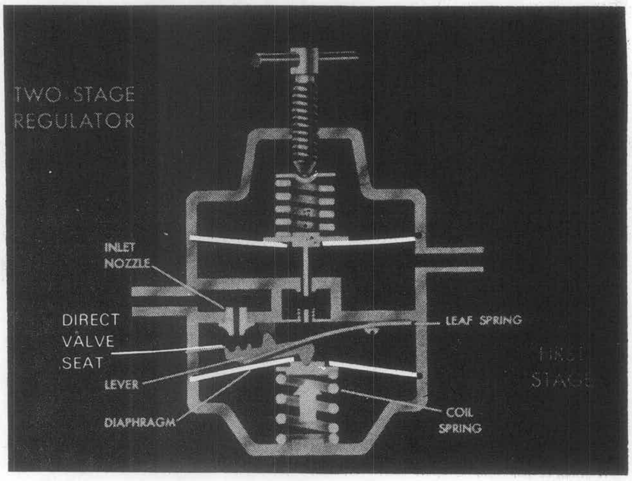


Figure C-11

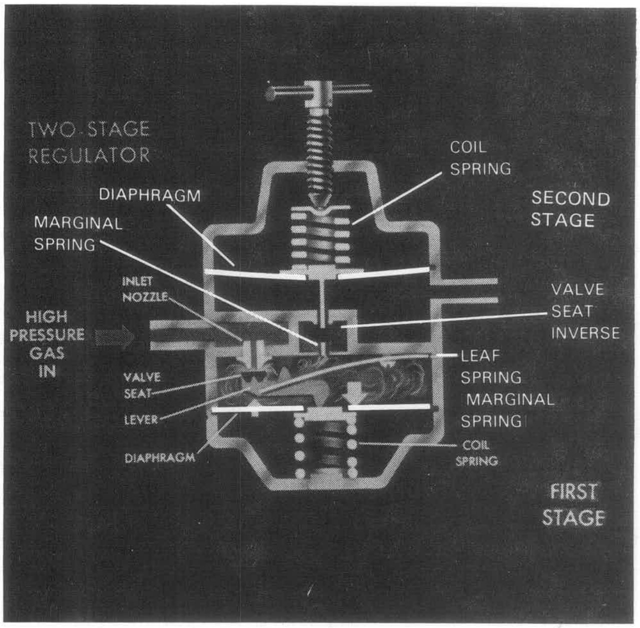


Figure C-12

GAS ENTERS SECOND STAGE.

Turning the adjusting screw to the desired delivery pressure causes the second stage to work in the same manner as singlestage regulator. The only difference is that the delivery pressure will remain *constant* throughout the entire withdrawal of the gas from the cylinder. The constant pressure results because the pressure exerted on the seat of the second-stage is constant.

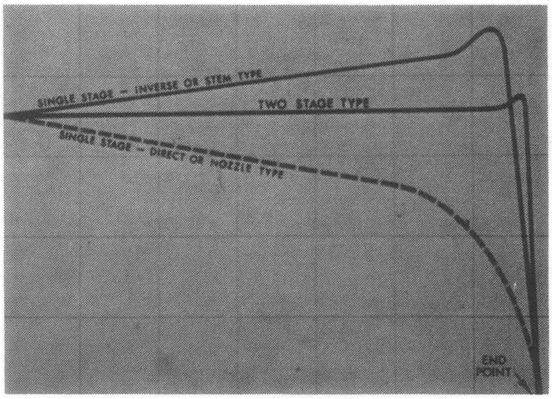


Figure C-13

4. PERFORMANCE TERMS

A. END-POINT

Regulation end-point is the value of cylinder (or inlet) pressure at which the regulator ceases to function adequately as a pressure regulating device.

The regulation end-point is an important measure of performance as it indicates whether the regulator is economical to operate. If the inlet pressure is high, as when a full cylinder or bank of cylinders is in use, the density of the gas discharging from the regulator is relatively great. As a result the discharge capacity of the regulator is considerably greater than it is at low cylinder pressures. For any given rate of discharge, there comes a time during the progressive draining of the cylinder when a cylinder pressure is reached below which the regulator ceases to function. Thus the regulation end-point is determined to some extent by the operating pressure and rate of flow to which the regulator is being subjected.

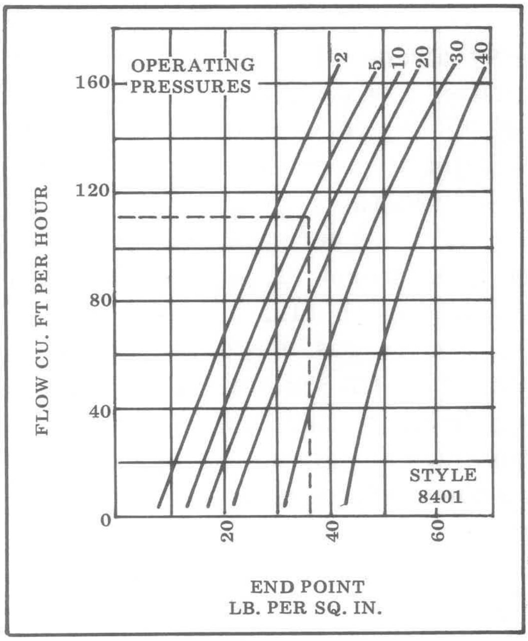


Figure C-14
End-Point Regulation

The charts on regulation end-point characteristics can be used as the basis for simple calculations for any known flow and outlet-pressure. For example, in the chart (Fig. C-14), to find the regulation end-point corresponding to a flow of 110 cubic feet per hour at 5 pounds per square inch pressure with a Style 8401 regulator, trace across from the 110 point on the vertical scale at the left of the chart to the pressure curve, thence vertically downward to the lower scale at the bottom, where we find the corresponding end-point of 37 pounds per-square-inch.

B. STATIC INCREMENT

APPROXIMATE STATIC INCREMENTS
STYLE 8400 — 9400 SERIES REGULATORS

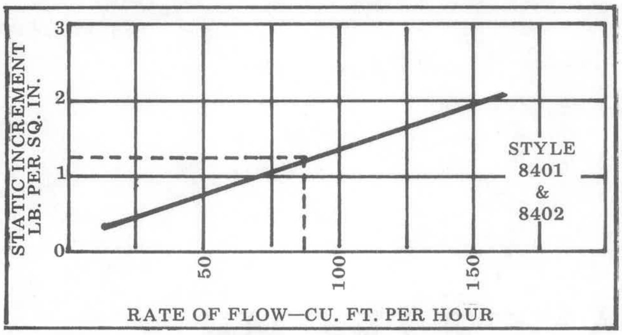


Figure C-15
Static Increment

Closely allied with the theory of pressure regulation is that of static increment which is the rise in delivery pressure of a regulator in satisfactory working condition when the discharge from the regulator is blocked. This pressure rise is necessary to press the regulator seat against the nozzle with sufficient force to stop the further discharge of the high-pressure gas. Regulators with a large static increment cannot satisfactorily regulate delivery pressure at low gas flows. To obtain the approximate static increments for any known volume rate of flow, refer to the chart for the particular regulator. To illustrate the use of this type of chart (Fig. C-15), find the static increment correpsonding to a rate of flow of 87 cubic-feet-per-hour (cfh) using a Style 8402 regulator. First locate 87 on the horizontal scale at the bottom of the chart, then trace vertically upwards to the diagonal line, move horizontally across to the left to the vertical scale denoting static increment which gives a figure representing 1.2 pounds per square inch.

C. CREEP

If the regulator is not in satisfactory working condition, there may be added to the static increment a further pressure increase which, in comparison, develops rather slowly and is generally known as "creep". It may result from imperfect design of the seat-carrying means, the presence of dirt, scale or other foreign matter — or from the use of faulty seat material. Most designs provide some special means for seat alignment which prevent any eccentric loose play in the movements of the seat.

D. SEAT IGNITION

The abrupt opening of the cylinder valve permits the gas within the high-pressure passages of the regulator to be suddenly compressed. This causes a marked rise of temperature within these passages. Some seat materials used in oxygen regulators readily ignite, and burn with explosive violence in the presence of hot oxygen, even though at more normal temperatures they are quite resistant to ignition. Ordinary dust which settles around any shop contains an appreciable amount of flammable particles which, when carried into a regulator through the inlet screen to the seat, may act as fuses and readily ignite the seat when other conditions are suitable. Seats with rough surfaces ignite more readily than seats with smooth surfaces. If the regulator is not equipped with an adequate strainer, the surface of the seat may become roughened by minute particles of scale or grit being driven at high velocity through the nozzle along with the gas stream. Through the combination of a pressed wire filter and the dead end passage principle, the resistance of the regulator to seat ignition has been improved over that of earlier designs.

E. SAFETY FEATURES

1. Valve

Because of possible admittance of full cylinder pressure into the low-pressure chamber of a regulator as a result of cracked seats or heavy creeps, regulators are equipped with a safety release designed to vent the low-pressure chamber in the event that an excessive working pressure develops.

Two-stage regulators are equipped with a safety device which automatically reseats itself after dissipation of over-pressure. Single-stage regulators are either equipped with the automatic reseating device or a breakable disc.

High-pressure gauges are so made that in case of rupture of the Bourdon tube, a flexible back plate in the gauge body will release the gas pressure, and thus avoid bursting the body and shattering the glass.

2. Dead End Passage

The dead end passage used in the first stage of an Airco two-stage regulator is a very important safety feature, designed to eliminate the possibility of seat ignition. Gas under high pressure flows rapidly into the regulator until it reaches the most remote blank end in the regulator body at which point the gas is instantaneously compressed, generating considerable heat. If the most remote blank end of the regulator body happens to be the seat, which is usually of some rubber composition, the danger of seat ignition with the accompanying harards is ever present. This danger is reduced to a negligible level by creating a dead-end pocket beyond the regulator seat. The effectiveness of this construction is that heat developed in any passage flooded with high-pressure gas is localized in the extreme end of the passage. This generation of high heat is practically an instantaneous reaction, and takes place only when the cylinder valve is opened. After the initial shock has taken place, and the regulator is placed in service, no further internal heat is generated and the hazard is removed.

LESSON PLAN

SUBJECT: SECTION D: THE AIRCO REGULATOR LINE

OBJECTIVE: To instruct the participant on the variety of regulators manufactured by AIRCO, stressing those regulators that are most popular for cylinder regulation, pipeline and station regulator, light duty, and specialty regulators. To make comparisons with competition.

REFERENCES: Product Information Class 8 Text

Section D. The Airco Regulator Line

TRAINING MATERIALS: SECTION D: THE AIRCO REGULATOR LINE
Chalkboard
Applied Exercise

PRESENTATION:
USE CHALKBOARD

A. Stock Number Identification.
  1. 806 — First three digits denote regulators only.
    a. Some numbers, 830 and 801, are included. 830 are flow adaptors and some flowmeters are 801.
  2. 806-9100, 806-8400
    a. Next two digits denote the series.
      (1) A series number is used 9100, 8400, etc.
        (a) Body configuration and basic mechanical design are the same regardless of gas service, within that series.
  3. 806-9100, 806-8409
    a. Last two digits denote gas service.
      Example: 806-9100 oxygen
                806-8409 acetylene

B. Cylinder Regulators
  1. Single Stage — inverse seat
    a. 9100 most popular
    b. 9200 newer series
    c. 8000 standard
    d. 8000 CO_2 and nitrous oxide, electrically heated
    e. 8000 Flowmeter Regulator
  2. Two Stage—direct and inverse seat
    a. 8400—9400 gauges
      (1) The 8400 Series Regulator ran out of stock numbers, therefore the numbering system was extended into 9400. We generally refer to this type of regulator as 8400—9400 Series.
    b. 9400 gaugeless
    c. 8400—9400 metering
    d. 8800 manifold
  3. Flowmeter and Flowmeter Adaptors
    a. Single Range Flowmeter for Argon and Helium 801
    b. Flow Adaptors for 8000 Series

REVIEW THE MATERIAL THAT IMMEDIATELY FOLLOWS THIS PAGE. GO OVER THE FEATURE AND BENEFIT CHART. THEN HAVE PARTICIPANTS TAKE THE APPLIED EXERCISE.

C. Review of the Regulator Line:

1. The regulators are placed in the text in order of popularity and sales volume.
2. Review the regulator CONDENSED CATALOG SHEETS in the text material beginning with 9100 series single-stage regulator, page D-12.

D. AIRCO Two-Stage Regulators Versus Competition

By every standard, Airco has the best two-stage regulator on the market. Here's why.

1. Airco has a combination of a direct and inverse seat mechanism. Whereas, in competition, both stages have inverse mechanism. Since a direct seat has a decreasing pressure characteristic, while the inverse seat has a rising pressure characteristic, the net effect is no pressure change. The net effect with two inverse seats in competitive regulators, is that the change is a rising pressure which requires readjustment during use.
2. The gauges on the Airco regulators are faced 90° away from the adjusting screw to minimize the chance of operator injury if excess pressure blows the gauge. In addition, the projection of material from the possible rupture of the high pressure gauge is shielded by the low pressure gauge in front.

   Competitive regulator gauges face the operator when setting pressures which is more prone to cause operator injury.

3. The safety relief valve of an Airco regulator discharges downward. If the regulator is overpressurized and discharges, it will not harm the operator.

   Some competitive regulators have no relief valve. They rely on the rupturing of the diaphragm and the gas exhausts through the face of the spring case into the operator's face.

4. The cylinder nut retaining ring protects the gland sealing surface from damage. Some competitors do not have this feature, such as, Victor and Linde. On their regulator the nut is loose and slides down which exposes the gland and it can easily be damaged.

TWO-STAGE REGULATOR
COMPARISON WITH COMPETITION

AIRCO		COMPETITION	
FEATURE	**BENEFIT**	**FEATURE**	**SHORTCOMING**
1. Combination direct and inverse seat	No pressure change No operator adjustment	Both stages are inverse	Rising pressure requires operator adjustment
2. Gauges are faced 90° away from adjusting screw High pressure gauge is shielded by low pressure gauge	Minimizes chance of operator injury In case of rupture flying parts are deflected	Gauges face the operator High pressure gauge is not shielded	More prone to injury Flying parts not deflected
3. Safety relief valve discharges downward	If regulator is over pressurized and discharges, it will not harm operator	Some do not have relief valve, rely on rupturing of the diaphragm	Gas exhausts through the face of the spring case into the operator's face
4. The cylinder nut retaining ring	Protects the gland sealing surface from damage	Cylinder nut is loose and slides down	Exposes the gland and can be damaged easily

APPLIED EXERCISE:

TWO-STAGE REGULATOR COMPARISON WITH COMPETITION

Given the AIRCO feature, place the appropriate benefit in the column marked BENEFIT. Given the competitive feature, place the appropriate short coming in the column marked SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	**FEATURE**	**SHORTCOMING**	**FEATURE**
	Combination direct and inverse seat		Both stages are inverse
	Gauges face 90° from adjusting screw		Gauges face the operator
	Safety relief valve discharges downward		Rupturing of the diaphragm

Check your answers on page D-5

SINGLE-STAGE REGULATORS

Two-stage regulators are used when constant pressure and flow are required. However, the single-stage regulator provides greater economy, low cost, and is used where the refinements of constant flow are not required and periodic adjustments are not of any concern.

When high flow is a requisite and pressure regulation of no great concern, the Airco single-stage regulator holds true as part of the Airco quality line.

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION D:
THE AIRCO REGULATOR LINE

1. Stock Number Identification
2. Cylinder Regulators
3. Pipeline and Station Regulators
4. Light Duty Regulators
5. Specialty Regulators

*6. Two-Stage Regulator—features and benefits

*7. Comparison with Competition

*8. Single-Stage Regulator

*6, 7 & 8 — appear in the outline section only

1. STOCK NUMBER IDENTIFICATION

The Airco Regulator Line consists of regulators for welding and cutting and for various gas applications used by the type of industries that Airco serves.

Other regulators, for beverages, air, or water are marketed by other firms, but they are out of the field of commerce and industry that Airco covers.

Airco regulators can be divided into lower-, medium-, and high-flow types. They also can be divided into current and specialty types. We are going to cover them by degree of importance to Airco. What we sell *most* is what we must be *best* acquainted with.

Airco regulators are grouped into series. Those in the same series have the same body configuration and basic mechanical design, regardless of the intended use. The series are defined by a part (stock) number. The Airco welding product part number systems consists, for most part, of seven digits. The first three denote the class of equipment, 806 denotes regulators, the next two digits denote the style, and the last two denote the intended service.

FLOW RATING OF CYLINDER REGULATORS

Two methods are used to rate gas regulator flow performances. They are the "Maximum Free Flow" or MFF and the "Maximum Conventional Application" or MCA.

The first method "MFF" shows the highest possible gas flow which can pass through a regulator under the best of circumstances. These flow figures are spectacular but meaningless for practical use. MFF would mean something if the maximum cylinder pressure would remain constant in spite of the high withdrawal rate of gas from the cylinder. The other method deals with realistic work conditions between manufacturers of regulators on how MCA should be defined. This can lead to misrepresentation. The best way of depicting the performance of a regulator is to plot it on a graph. One graph is needed for each specific model of regulator. However, graphs used in much of our industry literature show, with one curve, on one graph, the performance of a number of models of regulators of the same basic type but designed for various gas services and delivery pressures. These graphs use air as the testing medium, providing correction factors for the specific gas.

Whatever the intent, the result is deceptive information. It is easy to clearly state the performance of a regulator. Unfortunately the exuberance of salesmanship often tends to mystify the public, particularly when the equipment performance has nothing much to show over competition. In order to deal with the problem we have decided to indicate, in *table form two flow conditions for each regulator. The gas flow indicated are for the gas considered and there is no need to use correction factors. As an example, take an oxygen regulator built to deliver a maximum pressure of 120 psi. We show what the "MFF" or maximum free flow is when the pressure in the gas cylinder is at 2000 psi and what it is at the time that the cylinder pressure drops to a pressure representing a nearly empty cylinder. This well defines the limitation of the regulator when the cylinder is almost full and when it is almost empty.

*See Table on page D-12.

MAXIMUM DELIVERY PRESSURE VARIATION ON SINGLE STAGE REGULATOR

When looking at regulators of different brands but considered as equivalent in physical size and diaphragm area, it can be assumed that their performances are alike. This, however is not always the case. Some regulators are designed for high gas flow delivery, while others are designed for minimum delivery pressure variation during the entire cylinder discharge. It is not possible to have the highest gas flow delivery and minimum delivery pressure variation built in the same regulator. A well-designed, high flow delivery regulator will exhibit a larger pressure variation than a regulator designed for minimal pressure variation. This last regulator will have a more limited flow rate. The best average regulator is a compromise.

In an effort to compare regulators on an even basis, we have established flow data on a selection of competitive regulators used in welding and cutting outfits. The result is a comparison of performances and not a comparison of appearances. (See SECTION H)

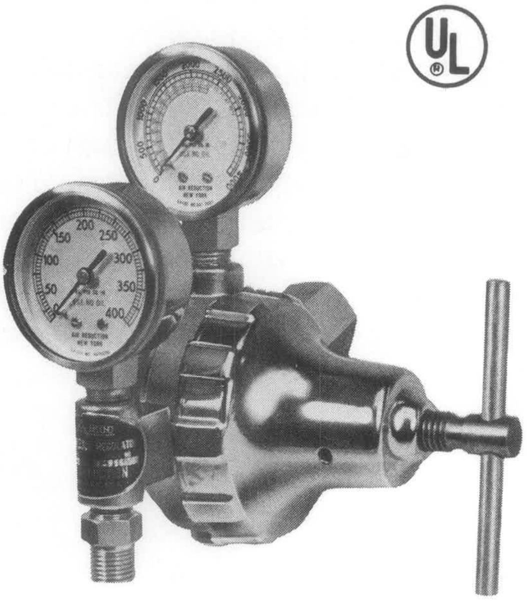
2. CYLINDER REGULATORS

9100 SERIES SINGLE-STAGE CYLINDER REGULATORS

APPLICATIONS

The Airco 9100 Series Single-Stage Cylinder Regulators are all-purpose regulators for use in welding, cutting, brazing and heating operations.

The Airco 9100 Series Regulators feature an inverse-type seat, designed to provide a slightly rising delivery or working pressure as cylinder pressure falls off.



IMPORTANT FEATURES

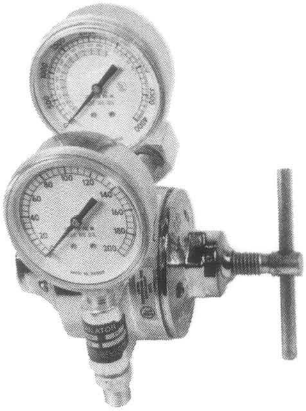
Airco 9100 Series Regulators feature a neoprene seat assembly which assures positive seating for reliable pressure regulation and accurate flow control.

These regulators employ an all neoprene diaphragm, convoluted to provide stressfree motion. The absence of bonded parts on the diaphragm, result in a long, trouble-free life.

Gas Service	Stock Number	Inlet CGA	Connections Outlet Fitting	Maxi. Delivery PSI	Maximum Flow Delivery				Delivery PSI Change
					Full Cylinder		Nearly Empty		
					CFH	PSI	CFH	PSI	
Oxygen	806-9100	540	"B" RH Ext.	180	3163	2000	1025	230	6
Oxygen	806-9106	540	"B" RH Ext.	120	1425	2000	560	150	6
Oxygen	806-9116	540	"B" RH Ext.	120	1425	2000	560	150	6
Acetylene	806-9102	300	"B" LH Ext.	15	570	250	315	35	.5
Acetylene	806-9109	510	"B" LH Ext.	15	570	250	315	35	.5
Hydrogen	806-9103	350	"B" LH Ext.	40	3460	2000	1040	50	6
Prop./MAPP	806-9132	510	"B" LH Ext.	40	350	110	220	50	6
Nit. W.P.	806-9105	580	"B" RH Int.	180	3400	2000	1100	230	6
Nit. W.P.	806-9121	580	"B" RH Int.	40	930	2000	280	50	6
Nit. O.P.	806-9122	555	"B" RH Int.	180	3400	2000	1100	50	6
Nit. O.P.	806-9124	555	"B" RH Int.	40	930	2000	280	50	6
Argon	806-9127	580	"B" RH Int.	40	775	2000	230	50	6
Helium	806-9138	350	"B" RH Int.	40	2460	2000	740	50	6
CO_2	806-9175	320	"B" RH Int.	40	540	2000	220	50	6

8400-9400 SERIES TWO-STAGE REGULATORS

Airco Two-Stage Regulators are actually two regulators in one, incorporating construction and operation features which offer decided advantages over single-stage regulators. Most important performance features are absolutely even delivery pressure and constant, non-fluctuating flow from the opening of the cylinder until it is almost empty (see chart on regulator characteristics for 8400-9400 Series.)

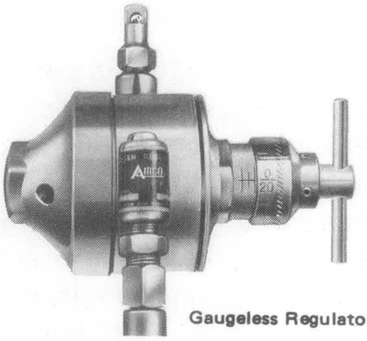


SPECIFICATIONS

Gas Service	Stock Number	Inlet CGA	Connections Outlet Fitting	Maxi. Delivery PSI	Maximum Flow Delivery				Delivery PSI Change
					Full Cylinder		Nearly Empty		
					CFH	PSI	CFH	PSI	
Oxygen	806-8401	540	"B" RH Ext.	40	450	2000	180	50	0
Oxygen	806-8456	540	"B" RH Ext.	100	975	2000	550	50	0
Acetylene	806-8402	300	"B" LH Ext.	15	300	250	250	35	0
Acetylene	806-8409	510	"B" LH Ext.	15	300	250	250	35	0
Acetylene	806-9419	510	"B" LH Ext.	15	300	250	250	35	0
Hydrogen	806-8403	350	"B" LH Ext.	40	1670	2000	710	50	0
Hydrogen	806-8413	350	"B" LH Ext.	40	1670	2000	710	50	0
Hydrogen	806-8414	550	"B" LH Ext.	40	1670	2000	710	50	0
Propane	806-8462	510	"B" LH Ext.	40	360	110	150	50	0
Nit. W.P.	806-9403	580	"B" LH Int.	40	460	2000	185	50	0
Argon	806-9403	580	"B" LH Int.	40	385	2000	160	50	0
Helium	806-9403	580	"B" LH Int.	40	1220	2000	500	50	0
Nit. W.P.	806-8420	540	"B" RH Int.	100	1000	2000	600	150	0
Nit. O.P.	806-8424	555	"B" RH Int.	40	460	2000	185	150	0
Nit. O.P.	806-8427	555	"B" RH Int.	100	1000	2000	600	150	0
Argon	806-8407	540	"B" RH Int.	40	385	2000	160	50	0
Argon	806-9414	540	"B" RH Int.	Preset 30	300	2000	160	50	0
Helium	806-8418	350	"B" RH Int.	40	1220	2000	500	50	0
Helium	806-9418	550	"B" RH Int.	40	1220	2000	500	50	0
Helium	806-9413	350	1/4 NPT Int.	Preset 30	945	2000	400	50	0
CO_2	806-9415	320	1/4 NPT Int.	Preset 30	230	2000	140	50	0
AG75	806-9413	350	1/4 NPT Int.	Preset 30					
Nit. O.P.	806-8438	555	"B" RH Int.	6	75				

9400 SERIES TWO-STAGE, GAUGELESS REGULATORS

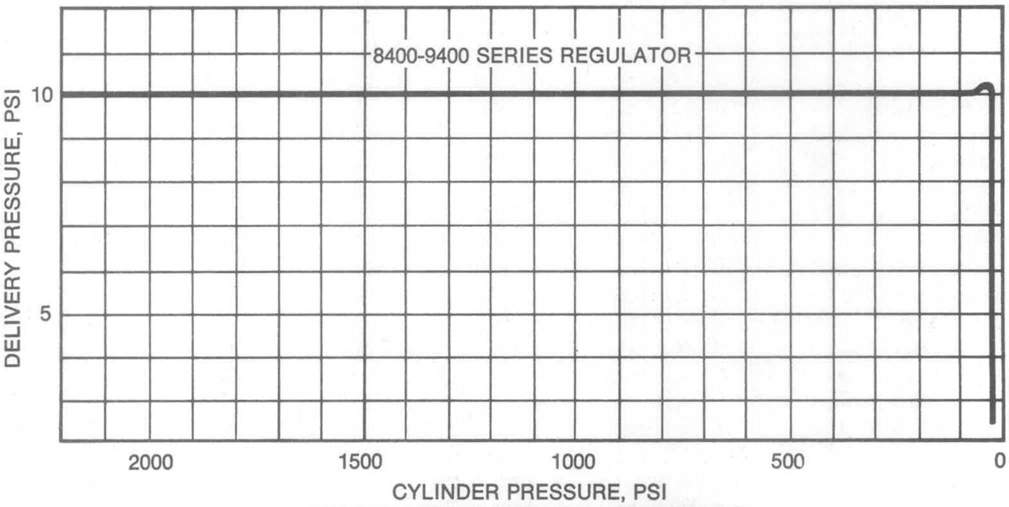
Operational features of the Airco 9400 Series Gaugeless Regulator include excellent two-stage regulation and constant delivery pressure until cylinder is almost empty. Accurate pressure settings are assured with a micrometer-type pressure indicator; no gauge to damage. A protected cylinder pressure indicator is located on top so that cylinder pressure can be readily checked.



Gaugeless Regulator

PERFORMANCE

		Connections		Maxi-Delivery PSI	Maximum Flow Delivery				Delivery PSI Change
Gas Service	Stock Number	Inlet CGA	Outlet Fitting		Full Cylinder		Nearly Empty		
Oxygen	806 9466	540	"B" RH Ext.	100	975	2000	550	50	0
Oxygen	806 9461	540	"B" RH Ext.	40	450	2000	180	50	0
Acetylene	806 9462	510	"B" LH Ext.	40	360	110	150	50	0
Acetylene	806 9469	510	"B" LH Ext.	15	300	250	250	35	0



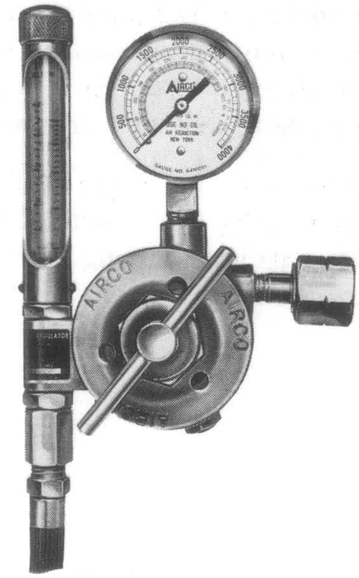
REGULATION CHARACTERISTICS

8400—9400 SERIES METERING REGULATORS

Airco 8400—9400 Series Metering Regulators provide both accurate two-stage pressure regulation and constant gas flow indications.

Ideal for use in Heliweld (TIG) and Aircomatic (MIG) welding processes and other industrial applications where accuracy, wide flow range and versatility are required.

It permits gas flow indications in two ranges — a low range, with flow-rate indications to an accuracy of plus or minus 10% and a high range, with indications to plus or minus 12%.



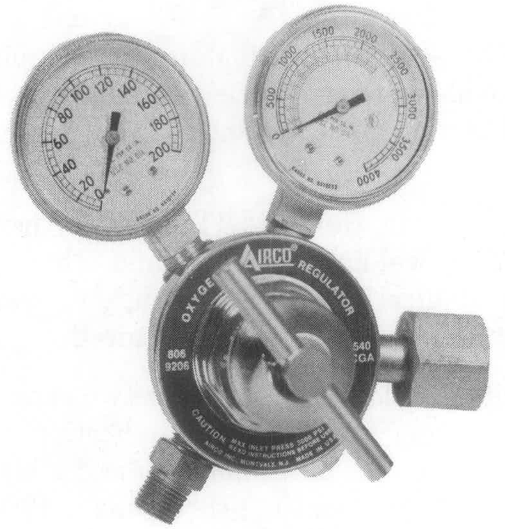
SPECIFICATIONS

Gas Service	Stock Number	Flowmeter and Gauge Equipment	Flow Capacity (Two Ranges)	Connections			Service
				CGA#	Inlet	Outlet	
Helium	806 8470	Flowmeter & 4000 lb.	Direct Reading Lower 4-40 CFH Upper 20-200 CFH	350	.830"-14 L.H. Int.	"B" 5/8"-18 R.H. Int.	For inert-gas-arc welding.
Argon	806 8474	Flowmeter & 4000 lb.	Direct Reading Lower 4-30 CFH Upper 20-150 CFH	540	.908"-14 R.H. Int.	"B" 5/8"-18 R.H. Int.	For inert-gas-arc welding.
Argon	806 9474	Flowmeter & 4000 lb.	Direct Reading Lower 4-30 CFH Upper 20-150 CFH	580	.960"-14 R.H. Ext.	"B" 5/8"-18 R.H. Int.	For inert-gas-arc welding.
25% Argon 75% Helium	806 8458	Flowmeter & 4000 lb.	Not Direct Reading Lower 5-45 CFH Upper 25-230 CFH Calibration Curve Supplied	350	.830"-14 L.H. Int.	"B" 5/8"-18 R.H. Int.	For inert-gas-arc welding.

9200 SERIES SINGLE-STAGE CYLINDER REGULATORS

Design of the 9200 Series Regulator provides for low cylinder end points. This is provided by the inverse type seat which provides slightly rising delivery pressure as cylinder pressure declines.

Versatile units for dependable gas regulation, in welding, cutting, heating, brazing, and gas control.



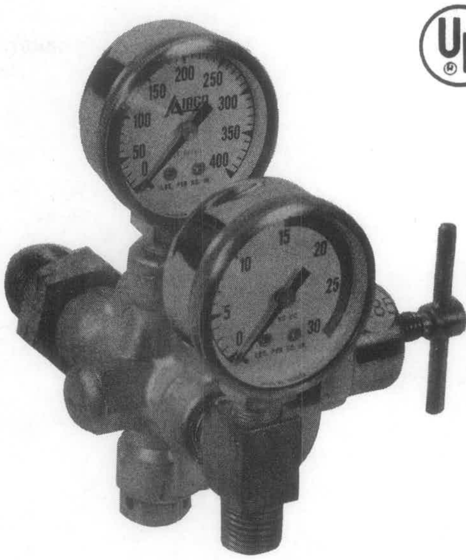
9200 SERIES REGULATORS— SPECIFICATIONS

Gas Service	Stock Number	Connections		Maxi-Delivery PSI	Maximum Flow Delivery				Delivery PSI Change
		Inlet CGA	Outlet Fitting		Full Cylinder		Nearly Empty		
					CFH	PSI	CFH	PSI	
Oxygen	806 9206	540	"B" RH Ext.	100	850	2000	830	150	16
Acetylene	806 9202	300	"B" LH Ext.	15	670	250	225	35	1
Acetylene	806 9209	510	"B" LH Ext.	15	670	250	225	35	1

8000 SERIES SINGLE-STAGE CYLINDER REGULATORS

Design of the 8000 Series Regulator provides for low cylinder end points. This is provided by the inverse type seat which provides slightly rising delivery pressure as cylinder pressure declines.

Versatile units for dependable gas regulation, in welding, cutting, heating, brazing, and gas control.



8000 SERIES REGULATORS— SPECIFICATIONS

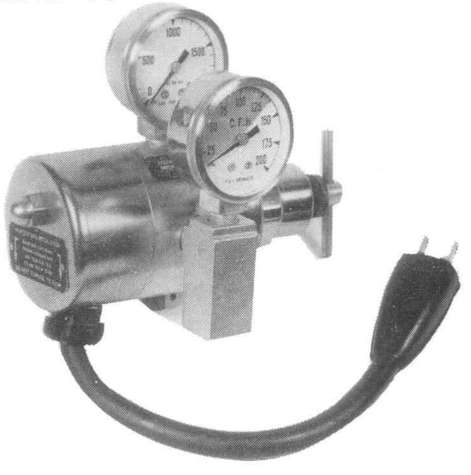
		Connections			Maximum Flow Delivery				
Gas Service	Stock Number	Inlet CGA	Outlet Fitting	Maxi. Delivery PSI	Full Cylinder		Nearly Empty		Delivery PSI Change
					CFH	PSI	CFH	PSI	
Oxygen	806-8001	540	"B" RH Ext.	40	630	2000	150	50	12
Oxygen	806-8006	540	"B" RH Ext.	100	1425	2000	375	150	12
Oxygen	806-8056	540	"B" RH Ext.	100	1425	2000	375	150	12
Acetylene	806-8002	300	"B" LH Ext.	15	290	250	215	35	1
Acetylene	806-8009	510	"B" LH Ext.	15	290	250	215	35	1
Acetylene	806-8012	520	"B" LH Ext.	15	290	250	215	35	1
Acetylene	806-8022	200	"B" LH Ext.	15	290	250	215	35	1
Acetylene	806-8052	300	"B" LH Ext.	15	290	250	215	35	1
CO_2	806-8015	320	1/8 NPT Int.	100	1225	2000	335	150	12
CO_2	806-8025	320	Petroleum Cock	100	1225	2000	335	150	12
CO_2	806-8045	320	1/4 NPT Int.	100	1225	2000	335	150	12
Propane	806-8049	510	"B" LH Ext.	40	285	110	130	50	12
CO_2	806-8035	320	"B" RH Int.	100	1225	2000	335	150	12
Oxygen	806-8026	540	"B" RH Ext.	100	1425	2000	375	150	12
Acetylene	806-8029	510	"B" LH Ext.	15	290	250	215	35	1
Acetylene	806-8082	300	"B" LH Ext.	15	290	250	215	35	1

CARBON DIOXIDE AND NITROUS OXIDE REGULATOR-
STYLE 806-8005, 7 AND 39

There are three models of Heated Regulators: The 806-8005 and the 806-8007 are for CO_2 SERVICE. The 806-8039 is for Nitrous oxide service.

Thermostatically-controlled heating system prevents internal dry ice crystal accumulation and CO_2 freeze-up, insuring uninterrupted CO_2 flow for any application.

Ideal for use the Fluxcor®, dip-transfer and buried arc CO_2 welding, furnace blanketing, purging, foundry, shrink fitting, and other applications requiring continuous CO_2 flows to 135 CFH.



Style 8005 CO_2 Electrically Heated Regulator

COMBINATION FLOW/PRESSURE GAUGE 806-8005

The regulator is supplied with two compact, rugged gauges—one graduated in psig to measure cylinder pressure, and one combination gauge, graduated in cfh, which serves as indicator of flow rates between 25 and 135 cfh. Through the use of a specially sized flow control orifice in the regulator outlet connection, the relative pressure within the regulator and the flow rate are numerically the same and can be read from a single scale on the combination gauge.

HEATING SYSTEM

The 115-volt, 1.3 amp heating system consists of a thermostat and three 50-watt heating cartridges. The heating cartridges transfer heat to the CO_2, minimizing the possibility of dry ice formation. Any ice crystals which may develop are eliminated as they travel through the heated passages of the regulator. Normally, the heaters cycle to maintain the regulator body temperature between control limits of 95°F and 120°F at the thermostat sensing point. Under conditions of maximum heat demand, the heating system operates continuously. Any frost which may accumulate on the external surfaces of the regulator is normal, and does not indicate a regulator freeze-up. A high temperature electric cut-out prevents overheating, protecting both personnel and equipment.

Stock No.	1½" Gauges	Max. Flow CFH (MCA)	Max. Pressure P.S.I.G.	CGA	Connections	
					Inlet	Outlet
806-8005	0-2000 P.S.I. 0-200	135 Orifice	120	320	.830"-14 R.H. Int.	5/8"-18 R.H. Int.
806-8007	0-2000 P.S.I. 0-200		120	320	.830"-14 R.H. Int	5/8"-18 R.H. Int
806-8039	0-2000 P.S.I. 0-200		120	1320	.830"-14 R.H. Int.	5/8"-18 R.H. Int

CO_2 FLOW PROBLEMS

1. Solid CO_2 particles (Dry Ice) clog flow control orifice causing sharp fluctuations in CO_2 flow which results in improper weld shielding and gas porosity. Flow is also restricted or reduced on applications other than welding.
2. Freeze-up that involves the formation of solid CO_2 during expansion which causes the moving parts of the regulator to stop.
3. Seat failure due to contamination from foreign matter such as water and oil entrained in the gas or the diffusion of CO_2 into the seat material.

THEORETICAL SOLUTION TO PRIMARY PROBLEM.

The expansion of a gas through an orifice from a high inlet pressure to a low outlet pressure is accompanied by a refrigeration effect. This cooling does not cause solidification of most gases since they do not form stable solids under ordinary conditions. However, carbon dioxide has a stable solid state known as dry ice. Signficiant accumulations of dry ice are formed when CO_2 gas is expanded from cylinder pressures above 950 psig (cylinder temperature above 79°F), to ordinary use pressures. The problem is magnified when high flows are required since increasing the flow causes more dry ice to be formed. The Style 8005 electrically heated regulator traps the dry ice formed during the expansion and vaproizes it before it reaches the flow control orifice so that clogging of the orifice does not occur.

REGULATOR DESIGN. This regulator is basically a standard single-stage regulator. However, it has an improved seat design and employs a teflon seat which is compatible with carbon dioxide. A special seat retainer is used in this regulator because the main flow path has been diverted through the diaphragm cavity in order to increase the area available for heat transfer.

READING FLOWS THROUGH REGULATOR

The orifice is sized so that the flow rate is numerically equal to the absolute pressure upstream from the flow orifice. The second gauge is graduated in absolute pressure so that one scale can be used to measure both regulated pressure and flow. If gauge pressure reading is desired, it is always 15 psi less than absolute. The location of an orifice downstream from the pressure gauge means that the outlet pressure (absolute) is indicated only under non-flow conditions. If delivery pressure is desired under flow conditions, gauge must be inserted downstream from the regulator. The regulator flow gauge is designed to be a simple, rugged flow indicator for general welding use. At flow rates above 25 cfh, the overall accuracy will be within 10% of indicated flow, an accuracy more than adequate for welding service.

It must be understood that this type of flow measurement is only correct if there is adequate pressure drop across the flow controlling orifice. This will normally be the case even with our most flow-restrictive welding equipment. If there is any question of whether high back pressure is restricting flow, this can be checked as follows:

a. Install a test gauge between the regulator outlet connection and the distribution system.

b. Take pressure readings from the test gauge and from the regulator operating gauge at the flow rate in question.

c. Use the following ratio formula to calculate the pressure ratio R.

$$R = \frac{\text{outlet pressure (psig)} + 15}{\text{operating gauge flow (psia)}}$$

d. Use Table I to determine accuracy of regulator flow indicator operating gauge.

TABLE I -- RATIO FORMULA TABLE

R	ACTUAL FLOW (PERCENT OF INDICATED FLOW) (%)
0.53 or less	100
0.6	98
0.65	96
0.7	93
0.75	88
0.8	81

EXAMPLE I: Flow = 100 cfh (100 psia), and test gauge pressure = 30 psig

$$R = \frac{30 + 15}{100} = 0.45$$

Since R = 0.45 is less than R = 0.53, flow = 100 cfh and regulator operating flow gauge is correct.

EXAMPLE II: Flow = 100 cfh (100 psia) and outlet pressure = 60 psig.

$$R = \frac{60 + 15}{100} = 0.75$$

Since R = 0.75, Table I indicates that actual flow is 88% of indicated flow or 88 cfh.

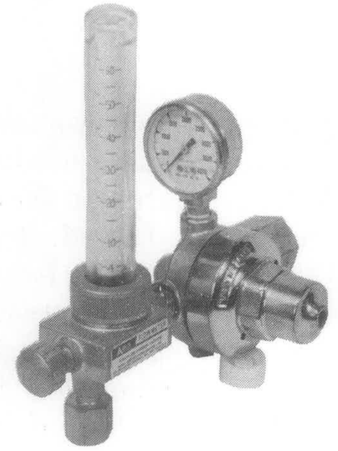
8000 SERIES, SINGLE-STAGE CYLINDER FLOWMETER REGULATORS

FIXED PRESSURE FLOWMETER REGULATORS

The fixed pressure, flowmeter regulators operate in range of flow suitable for practically all gas-shielded, metal arc welding jobs. They also handle the gas flow requirements for many other applications. These regulators consist of a pre-set 8000 series single-stage regulator and a float-type, variable area flowmeter that indicates flow directly in cubic-feet-per hour. There is no surer way to indicate flow. No correction factor is required and the reading accuracy is not affected by back pressure. Flow adjustment is made with a knurled knob that controls a needle valve in the flowmeter's body.

FIXED PRESSURE REGULATORS

Fixed pressure regulators are used with fixed orifice adapters to obtain desired flow. For these adapters refer to page D-28.



FIXED PRESSURE FLOWMETER REGULATORS

Gas Service	Stock No.	1½" P.S.I. Pressure Gauges	Max. Flow CFH	Max. Work Pressure P.S.I.	Connections		
					CGA No.	Inlet	Outlet
Argon	806-8027	4000 & Flowmeter	4 to 60	Preset at 30	540	.908"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.
Argon	806-8017	4000 & Flowmeter	4 to 60	Preset at 30	580	.960"—14 R.H. Ext.	"B" 5/8"—18 R.H. Int.
Helium	806-8018	4000 & Flowmeter	4 to 100	Preset at 30	350	.350"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.
CO_2	806-8019	2000 & Flowmeter	4 to 60	Preset at 30	320	.830"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.

FIXED PRESSURE REGULATORS

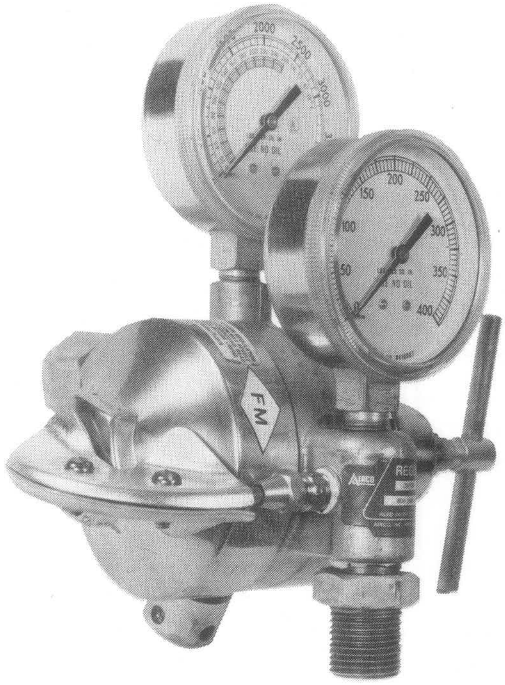
Gas Service	Stock No.	1½" P.S.I. Pressure Gauges	Max. Flow CFH	Max. Work Pressure P.S.I.	Connections		
					CGA No.	Inlet	Outlet
Argon	806-8054	4000 only	2.9 to 50	Preset at 30	540	.908"—14 R.H. Int.	1/4 NPT. INT.
Argon	806-8044	4000 only	2.9 to 50	Preset at 30	580	.960"—14 R.H. Ext.	1/4 NPT. INT.
Helium	806-8053	4000 only	12 to 150	Preset at 30	350	.830"—14 L.H. Int.	1/4 NPT. INT.
CO_2	806-8055	2000 only	2.6 to 45	Preset at 30	320	.830"—14 R.H. Int.	1/4 NPT. INT.
AG-75	806-8053	4000 only	4.8 to 79	Preset at 30	350	.830"—14 L.H. Int.	1/4 NPT. INT.

BALLOON FILLING REGULATORS

Gas Service	Stock No.	Pressure Gauges	Max. Flow CFH	Max. Work Pressure		Connections	
					CGA No.	Inlet	Outlet
Helium	806-8070	none		Preset at Factory	350	.830"—14 L.H. Int.	Filler Valve

CYLINDER OR MANIFOLD REGULATORS
8800 SERIES TWO-STAGE MANIFOLD REGULATORS

8800 Series Adjustable Manifold Regulators combine high gas flow capabilities with accurate two-stage pressure control. The highly responsive two-stage system utilizes large Neoprene diaphragms to ensure long life and precise control of delivery pressure.



8800 SERIES

Gas Service	Stock Number	Connections		Maxi-Delivery P.S.I.	Maximum Flow Delivery				Delivery P.S.I. Change
		Inlet CGA	Outlet Fitting		Full Cylinder		Nearly Empty		
					CFH	P.S.I.	CFH	P.S.I.	
Oxygen	806-8800	540	"C" R.H. Ext.	200	2770	2000	2150	250	0
Acetylene	806-8802	300	"C" L.H. Ext.	15					
Hydrogen	806-8803	350	"C" L.H. Ext.	200	11050	2000	8575	250	0
Hydrogen	806-8804	550	"C" L.H. Ext.	200	11050	2000	8575	250	0
Helium	806-8818	550	"C" L.H. Ext.	50	2015	2000	1570	75	0
Nit. W. P.	806-8820	540	"C" R.H. Ext.	200	2975	2000	2310	250	0
Argon	806-8821	540	"C" R.H. Ext.	50	635	2000	500	75	0
Nit. O. P.	806-8822	555	"C" L.H. Ext.	200	2975	2000	2310	250	0
Prop/MAPP	806-8842	550	"C" L.H. Ext.	50		110			
CO_2	806-8875	320	"C" R.H. Ext.	180					

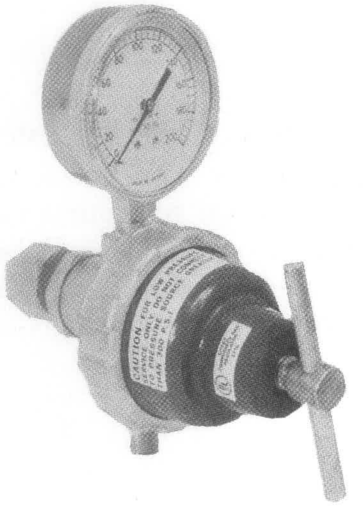
FOR INSTRUCTIONS AND PARTS SEE ADI 831

3. PIPELINE AND STATION REGULATORS

9900 SERIES STATION REGULATORS

Standard 9900 Series Medium Pressure Regulators are especially suited for gases distributed by pipeline networks with inlet pressures not exceeding 300 p.s.i. They handle most types of industrial gases, including oxygen, acetylene, hydrogen, nitrogen, natural gas, propane, CO_2, compressed air, water service, argon, helium, and MAPP Gas.

9900 Series Medium Pressure Regulators feature a unique seating arrangement requiring no metal nozzle. Its phase dampening system provides constant delivery pressure without fluctuations, regardless of line pressure variation, eliminating frequent manual adjustments.



SPECIFICATIONS

Gas Service	Stock Number	2½" P.S.I. Pressure Gauge	Maximum Flow (CFH)	Delivery Pressure (P.S.I.)	Connections		Service
					Inlet	Outlet	
Oxygen	806-9951	60 lb.	425	40	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	For welding operations. Can be directly attached to Airco ½" pipeline station valve 801-0469 or ½" pipeline adapter 839-6420.
Oxygen	806-9991*	60 lb.	425	40	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	
Oxygen	806-9931	60 lb.	425	40	"B" 7/9"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	For welding operations. Can be directly attached to Airco ½" pipeline station valve 801-0233 0231.
Oxygen	806-9950	200 lb.	1500	150	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	For cutting operations. Can be directly attached to Airco ½" pipeline station valve 801-0469 or ½" pipeline adapter 839-6420.
Oxygen	806-9990*	200 lb.	1500	150	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	
Oxygen	806-9930	200 lb.	1500	150	"C" 7/8"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.	For cutting operations. Can be directly attached to Airco ½" pipeline station valve 801-0233 or ½" pipeline adapter 803-0231.
Oxygen	806-9920	200 lb.	1500	150	1/4" NPT Int. For Cutt. Mach.	1/4" NPT Int. For Cutt. Mach.	
Acetylene	806-9932	30 lb.	200	13	"C" 7/8"—14 L.H. Int.	"B" 9/16"—18 L.H. Ext.	For welding or cutting. Can be directly attached to Airco ½" pipeline station valve 801-0232 or ½" pipeline adapter 803-0069.
Acetylene	806-9992	30 lb.	200	13	1/4" NPT Int. For Cutt. Mach.	1/4" NPT Int. For Cutt. Mach.	
Acetylene	806-9952	30 lb.	200	13	.830"—14 L.H. Int.	"B" 9/16—18 L.H. Ext.	For welding or cutting. Can be directly attached to Airco ½" pipeline station valve 801-0468 or ½" pipeline adapter 839-4976.
Acetylene	806-9954	30 lb.	200	13	.908"—14 L.H. Int.	"B" 9/16"—18 L.H. Ext.	For welding on cutting. Can be directly attached to Airco ½" pipeline station valve 801-0170 or ½" pipeline adapter 839-7669.

FOR OPERATING INSTRUCTIONS AND PARTS LIST, SEE ADI-1473

PIPELINE AND STATION REGULATORS SPECIFICATIONS

Gas Service	Stock Number	2½" P.S.I. Pressure Gauge	Maximum	Delivery	Connections		Service
			Flow (CFH)	Pressure (P.S.I.)	Inlet	Outlet	
Acetylene	806-9942	60 lb.	200	13	.830"—14 L.H. Int.	"B" 9/16"—18 L.H. Ext.	For cutting and heating. Can be attached directly to Airco ½" pipeline station valve 801-0468 or ½" pipeline adapter 809-4976.
Propane			340	40			
or Natural Gas			570	40			
Nitrogen	806-9964	60 lb.	425	40	.908"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.	For heat treating atmospheres and flushing molten metal.
Nitrogen	806-9974	200 lb.	1500	150	.908"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.	Can be directly attached to Airco ½" pipeline station valve 801-0170 or ½" pipeline adapter 839-7669.
Hydrogen	806-9953	60 lb.	1620	40	.830"—14 L.H. Int.	"B" 9/16"—18 L.H. Ext.	For cutting or lead welding. Can be attached directly to Airco pipeline station valve 801-0468 or ½" pipeline adapter 839-4976.
Argon	806-9961	60 lb.	360	40	.908"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.	For inert gas shielded arc welding. Fits Airco ½" pipeline station valve 801-0469 or ½" pipeline adapter 839-6420.
CO_2	806-9975	60 lb.	340	40	"C" 7/8"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.	For inert gas welding process. Fits Airco ½" station valve 801-0233 or ½" pipeline adapter 803-0231.
Air or Nitrogen	806-9957	60 lb.	450	25	.908"—14 L.H. Int.	"B" 5/8"—18 L.H. Int.	For use with Airco pneumatic type powder feeder 804-3600 or ½" station valve 801-0170 or ½" pipeline adapter 839-7669.
Compressed	806-9958	200 lb.	1500	150	.830"—14 R.H. Int.	*.675"—18 R.H. Ext.	For use with metal-spraying operations. Fits ½" valve 801-0468 w/adapter 801-0085 or ½" pipeline adapter 839-6432.
Water Service	806-9999	60 lb.	10 Pints of Water per Minute	40	1/4"—NPT. THD. Int.	"B" 5/8"—18 L.H. Int.	For use with Heliweld and Aircomatic water cooled equipment that require certain water pressure.
General Purpose	806-9969	200 lb.	Oxygen 1500	150	1/4"—NPT. THD. Int.	1/4"—NPT. THD. Int.	Same as above.
MAPP MPS Gas Propane	806-9992	60 lb.	340	40	.880"—14 L.H. Ext. (C.G.A. 510)	"B" 9/16"—18 L.H. Ext.	For welding, cutting and heating.
MAPP MPS Gas Propane	806-9994	60 lb.	340	40	1/4"—NPT. THD. Int.	1/4" NPT. THD. Int.	For welding and cutting. Outlet and inlet fittings have 1/4" NPT thread for direct attachment to 1/4" pipe.

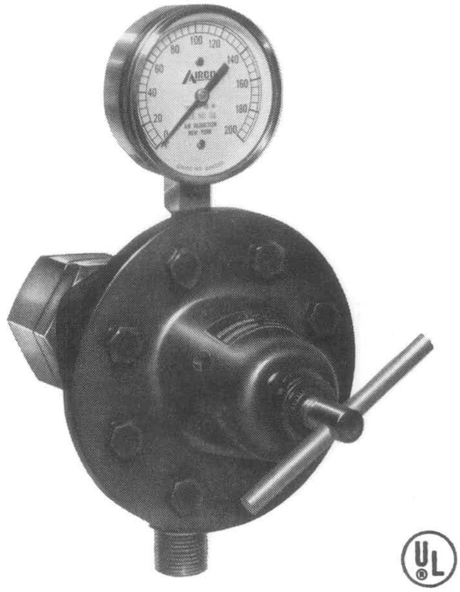
*3/8" NPS EASTMAN/COUPLING CU. NO. 897

9500 SERIES STATION REGULATORS

Gas Service and Stock No.	2½" P.S.I. Pressure Gauge	Maximum	Delivery	Connections		Service
		Flow (CFH)	Pressure (P.S.I.)	Inlet	Outlet	
MAPP Gas Natural Gas Propane 806-9542	60		40	830-14 L.H. Int.	"B" 9/16—18 L.H. Ext	Brazing Heating Cutting
Oxygen 806-9551	200			CGA 540	"B" 9/16—18 R.H. Ext.	Weld. & Cutting
Acetylene 806-9552	30		15	830-14 L.H. Int.	"B" 9/16—18 L.H. Ext.	Weld. & Cutting
Argon 806-9561				CGA 540	"B" 5/8—18 R.H. Int.	Inert Gas Arc Welding
MAPP Gas 806-9592	60		40	CGA 510	"B" 9/16—18 L.H. Ext.	Cylinder Operating

8700 SERIES HEAVY-DUTY STATION REGULATORS

Delivery Pressure Controls for Pipeline Gas Transmission



8700-Series Regulators are for high gas flow requirements—even with line pressures only a few pounds above delivery pressure. The 8700 Regulators are designed to control delivery pressure from a pipeline where maximum inlet pressure to gas distribution system, machine, heavy duty torch or gas function device does not exceed 300 p.s.i. Consistent delivery pressure is maintained by a phase dampening system—regardless of minor variations in inlet pressure.

- Forged corrosion resistant body for strength and durability.
- Neoprene seat and large diaphragm for long life and accurate control.
- Inlet filter has large surface area to minimize pressure drop while protecting entire systems.
- U.L. listed.

SPECIFICATIONS HEAVY DUTY STATION REGULATORS

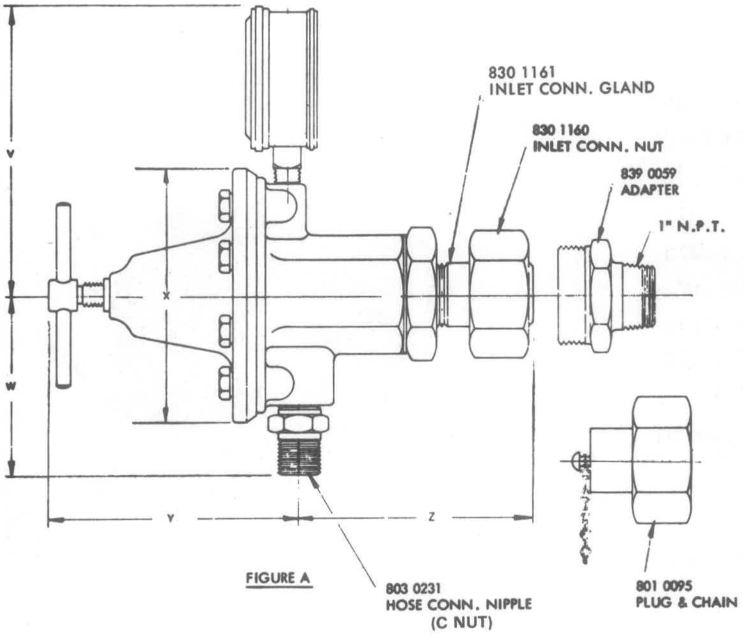


FIGURE A

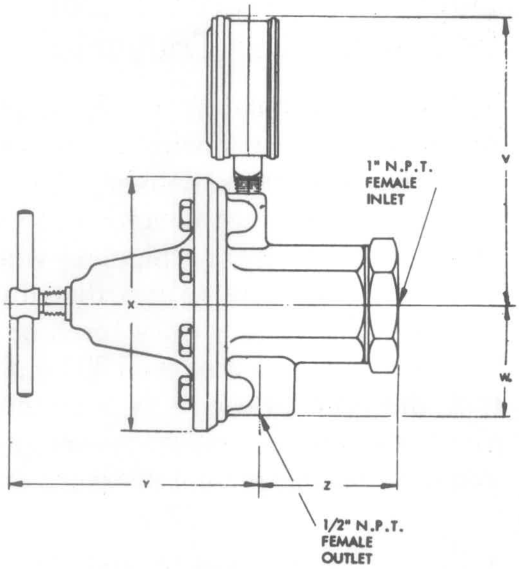


FIGURE B

Gas Service	Stock Number	Figure	Max. Inlet Pressure (P.S.I.)	M.C.A. Maximum Delivery Flow (CFH)	M.C.A. Maximum Delivery Pressure (P.S.I.)	DIM V	DIM W	DIM X	DIM Y	DIM Z
Oxygen	806-8769	B W/Elbow & 803-0069	300	5000	150	5-3/4	2-1/4	5-3/16	5-3/8	2-7/8
Oxygen	806-8771	A	300	5000	150	5-3/4	3-1/2	5-3/16	5-3/8	4-1/2
CO_2	806-8775	B	300	4000†	150	5-3/4	2-1/4	5-3/16	5-3/8	2-7/8
General* Purpose	806-8791	B	300	5000 (Air)	150	5-3/4	2-1/4	5-3/16	5-3/8	2-7/8
General* Purpose	806-8792	B	300	850 (Air)	40	5-3/4	2-1/4	5-3/16	5-3/8	2-7/8

*If used in acetylene service, maximum inlet pressure is 15 p.s.i., and maximum delivery pressure is 13 p.s.i.

†Continued flow of carbon dioxide at rates of flow in excess of 35 cfh can cause the regulator to "Freeze Up" unless an auxiliary heater is used.

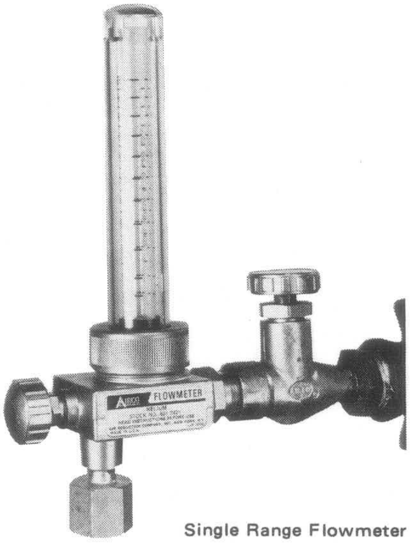
FOR INSTRUCTIONS AND PARTS SEE ADI-1432A-P

SINGLE—RANGE FLOWMETERS FOR ARGON-HELIUM-CO_2

These direct reading flowmeters are simple, precision-built instruments for the measurement of gas flow. They are designed to provide a reliable, efficient, and reasonably priced flowmeter for research, gas shielded arc welding, and a variety of other industrial applications. They can also be used to mix gases when only one preset flow setting is called for.

Two types of flowmeters are provided. One that connects to a 1/4" pipeline station valve, 801-0259, or to a preset regulator of the 8000 type with a 1/8" close pipe nipple.

See Fixed Pressure Cylinder Regulator 8000 Series page D-20.



Single Range Flowmeter

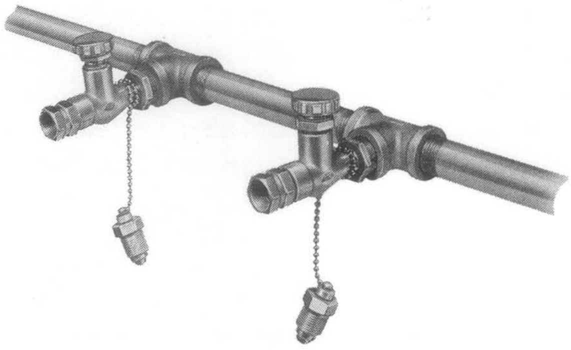
BENEFITS

- Easy accurate flow adjustment. Flow read at middle of ball.
- Direct reading at 30 psi inlet pressure.
- Easy readability—large black letters on white background.
- Interchangeable flow tubes and balls on common body.
- Simple design for minimum maintenance.
- Gas-tight "O" Ring seals.

GAS SERVICE	STOCK NUMBER	FLOW CAPACITY CFH	CONNECTIONS	
			INLET	OUTLET
Argon or CO_2	801-0420	4-60	5/8"-18 R.H. Ext.	5/8"-18 R.H. Int.
Helium	801-0421	4-100	5/8"-18 R.H. Ext.	5/8"-18 R.H. Int.
Argon or CO_2	801-0422	4-60	1/8" NPT Int.	5/8"-18 R.H. Int.
Helium	801-0423	4-100	1/8" NPT Int.	5/8"-18 R.H. Int.
Universal	801-0430	Request flow chart drwg. 830-3187	5/8"-18 R.H. Ext.	5/8"-18 R.H. Int.

FLOW ADAPTERS

FOR PIPE LINE AND FIXED PRESSURE REGULATORS
8000 SERIES



Most operators are inclined to use gas flows far in excess of that required for their inert gas application. To save valuable gas and yet be sure that you have the proper flow, use flow adapters on your pipeline outlets. These adapters come in many sizes and are machined from brass bar stock. They are accurately sized and equipped with an inlet filter to protect the orifice. The inlet threads are 1/4" N.P.T. male and their 5/8"-18 R.H. int. outlet takes an IAA "B" size hose connection for inert gases. AIRCO station valve 801-0281 is available to receive these adapters. Plug and chain assembly 801-0267 should be used so that the unused outlet can be plugged. This will prevent gas leakage from the outlet if the valve should be accidentally left open. Gas leakage could be both expensive and dangerous.

SPECIFICATIONS

Orifice Size	Stock No.	Argon Flow CFH	Helium Flow CFH	CO_2 Flow CFH	AG-75 Flow CFH
.010	830-1977	2.9	12	2.6	4.8
.0135	830-1978	5.2	20	4.7	9
.016	830-1979	7.2	25	6.6	15
.016	830-1983	7.2	25	6.6	15
.018	830-1971	10	30	8.4	15.4
.018	830-1980	10	30	8.4	15.4
.020	830-1984	11.4	35.5	10.5	20
.021	830-1972	15	39	11.5	21
.025	830-1973	20	56	16.5	30
.028	830-1985	22.5	72	21	40
.0312	830-1974	30	92	28	50
.0312	830-1986	30	92	28	50
.0312	830-2013	30	92	28	50
.035	830-1975	40.9	115	35	60
.035	830-1981	40.9	115	35	60
.040	830-1976	50	150	45	79
.040	830-1982	50	150	45	79

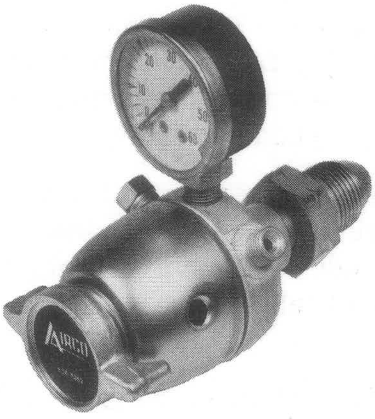
4. LIGHT DUTY REGULATORS

7000 SERIES SINGLE-STAGE CYLINDER REGULATORS

FOR OXYGEN

FOR ACETYLENE

FOR LP GAS



The 7000 Series provides an inexpensive means of regulating fuel and oxygen supply. They are used predominantly with gas-air soldering and brazing equipment by plumbing and air-conditioning contractors. These regulators deliver sufficient gas flow to cut 2" of steel or weld 1/4" steel plate. Refer to the sections on Torches and Torch Tips for light duty welding and cutting systems.

Refer to the Torch and Torch Tip section for Air Fuel Torch and for Conventional and Ram Jet™ Gas-Air equipment.

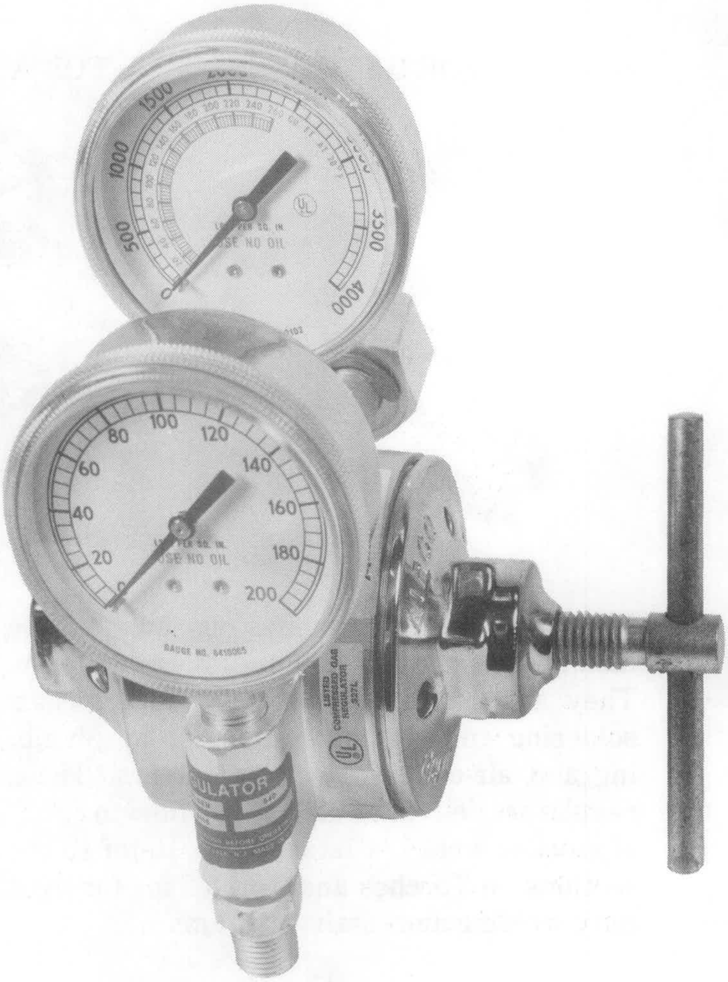
There are other fields in which this type of regulator fits well, such as arts and crafts for metal sculpture, for example, and all sorts of hobbies requiring the use of high temperature flames.

5. SPECIALTY REGULATORS

9300 SERIES
TWO-STAGE STAINLESS STEEL DIAPHRAGM REGULATORS

Airco Two-Stage Stainless-Steel-Diaphragm Regulators are actually two regulators in one insuring absolutely even delivery pressure and constant, non-fluctuating flow from start until cylinder is empty.

They are used for reducing gas cylinder pressure to a desired, constant working pressure in industrial environments which are injurious to rubber type regulator diaphragms.

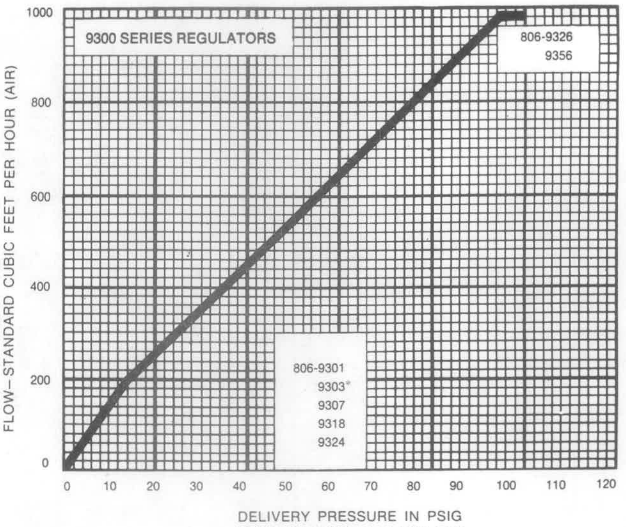


STAINLESS STEEL DIAPHRAGM

The stainless steel diaphragm resist corrosion and fatigue providing longer service. The stainless steel diaphragms also maintain their elasticity—don't "set" under pressure providing minimum fluctuation in pressure regulation characteristics throughout the service life of the regulator.

Flows on the curve are based on air flow, and must be converted to give the flow for the actual service gas. This is done by multiplying the maximum flow derived from the curve by one of these appropriate factors:

GAS SERVICE	FACTOR
Oxygen	.95
Hydrogen	3.79
Nitrogen	1.02
Argon	.85
Helium	2.7



*FLOW CAPACITY IS 75 CFH (AIR)

Gas Service	Stock Number	2½" P.S.I. Pressure Gauges	Maximum Delivery		Connections		
			Flow (CFH)	Pressure (P.S.I.)	CGA No.	Inlet	Outlet
Oxygen	806-9301	60 & 4000	450	40	540	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.
Oxygen	806-9356	200 & 4000	975	100	540	.908"—14 R.H. Int.	"B" 9/16"—18 R.H. Ext.
Hydrogen	806-9303	60 & 4000	285	40	350	.830"—14 L.H. Int.	"B" 9/16"—18 L.H. Ext.
Nitrogen O.P.	806-9324	60 & 4000	450	40	550	.908"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.
Nitrogen O.P.	806-9326	200 & 4000	975	100	550	.908"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.
W.P. Nitrogen	806-9307	60 & 4000	450	40	540	.908"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.
Argon	806-9307	60 & 4000	380	40	540	.908"—14 R.H. Int.	"B" 5/8"—18 R.H. Int.
Helium	806-9318	60 & 4000	1220	40	350	.830"—14 L.H. Int.	"B" 5/8"—18 R.H. Int.

9000 SERIES SINGLE-STAGE STAINLESS STEEL DIAPHRAGM REGULATORS

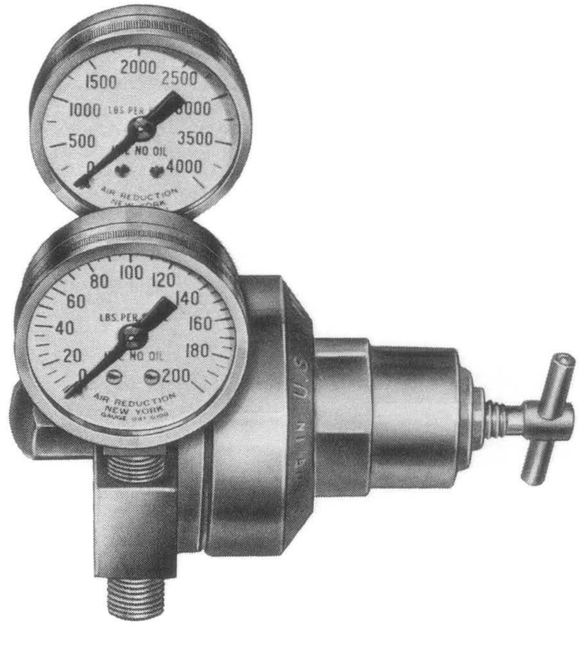
For Use In High-Purity Gas Systems

CYLINDER TYPE

Airco 9000 Series Single-Stage Regulators with stainless steel diaphragm, forged brass body and metal-to-metal seals effectively minimize the invasion of contaminants in high purity gas systems.

Ideal for use in production and research grade gas systems requiring high purity control equipment with low diffusion and leakage rates.

Typical applications include blanketing, heat treating, vacuum flushing, inerting, propelling and nitriding processes, as well as for gas chromatography, food packaging, electron beam welding and in the manufacture of electronic components.



STAINLESS STEEL DIAPHRAGM

All 9000 Series Regulators are equipped with a stainless steel, non-permeable diaphragm. The precisely engineered diaphragm provides a positive separation between the sealed flow passages of the regulator and external gaseous impurities. Solid foreign matter is kept from entering the regulator by an inlet filter of wire mesh.

Flows on the curve are based on *air* flow, and must be converted to give the flow for the actual service gas. This is done by multiplying the maximum flow derived from the curve by one of the appropriate factors listed below:

GAS SERVICE	FACTOR
Oxygen	.95
Hydrogen	3.79
Nitrogen	1.02
Argon	.85
Helium	2.7

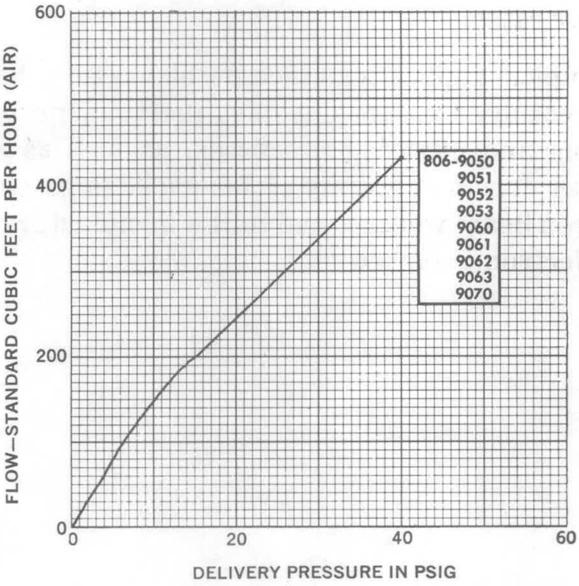
SPECIFICATIONS — CYLINDER REGULATORS

Gas Service	Stock Number	1½” P.S.I. Pressure Gauge	Maximum Delivery		CGA No.	Connections	
			Flow (CFH)	Pressure (P.S.I.)		Inlet	Outlet
Oxygen	806-9051	100	425	40	540	.908”—14 R.H. Int.	“B” 9/16”—18 R.H. Ext.
Oxygen	806-9061	60 & 4000	425	40	540	.908”—14 R.H. Int.	“B” 9/16”—18 R.H. Ext.
Hydrogen	806-9053	100	1610	40	350	.830”—14 L.H. Int.	“B” 9/16”—18 L.H. Ext.
Hydrogen	806-9063	60 & 4000	1610	40	350	.830”—14 L.H. Int.	“B” 9/16”—18 L.H. Ext.
Nitrogen O.P.	806-9050	100	425	40	550	.908”—14 L.H. Int.	“B” 5/8”—18 R.H. Int.
Nitrogen O.P.	806-9060	60 & 4000	425	40	550	.908”—14 L.H. In.t	“B” 5/8”—18 R.H. Int.
W.P. Nitrogen	806-9052	100	425	40	580	.960”—14 R.H. Ext.	“B” 5/8”—18 R.H. Int.
W.P. Nitrogen	806-9062	60 & 4000	425	40	580	.960”—14 R.H. Ext.	“B” 5/8”—18 R.H. Int.
Argon	806-9052	100	360	40	580	.960”—14 R.H. Ext.	“B” 5/8”—18 R.H. Int.
Argon	806-9062	60 & 4000	360	40	580	.960”—14 R.H. Ext.	“B” 5/8”—18 R.H. Int.
Helium	806-9053	100	1150	40	350	.830”—14 L.H. Int.	“B” 9/16”—18 L.H. Ext.
Helium	806-9063	60 & 4000	1150	40	350	.830”—14 L.H. Int.	“B” 9/16”—18 L.H. Ext.

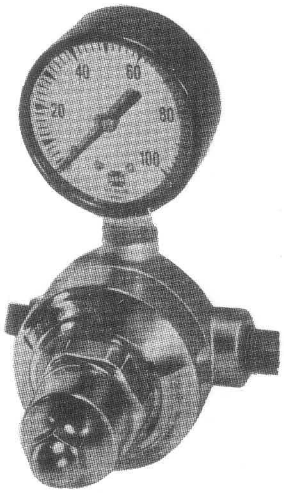
METAL-TO-METAL SEALS

The inlet and outlet fittings are attached to the regulator body with metal-to-metal seals which minimize gas leakage. No chemical sealants to act as a source of contamination are used.

Flows shown on the graph are based on reasonable pressure drops in the delivery system and relatively low cylinder end points. Higher than indicated flows are possible if a greater pressure drop in the delivery system, and a higher cylinder end point can be tolerated. Plot points identified by regulator stock numbers represent flows at maximum working pressures.



9000 SERIES PIPELINE REGULATOR



PIPELINE STATION APPLICATIONS
The Airco 9000 Series Regulator, for use in high-purity gas pipeline installation is recommended for the same applications as cylinder regulators. However, inlet pressures must be less than 300 psi.

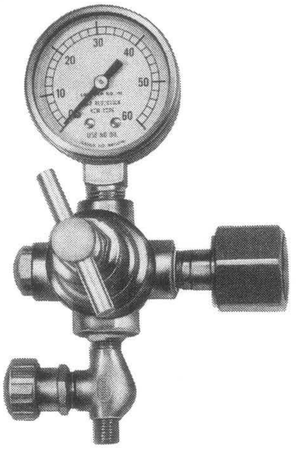
SPECIFICATIONS

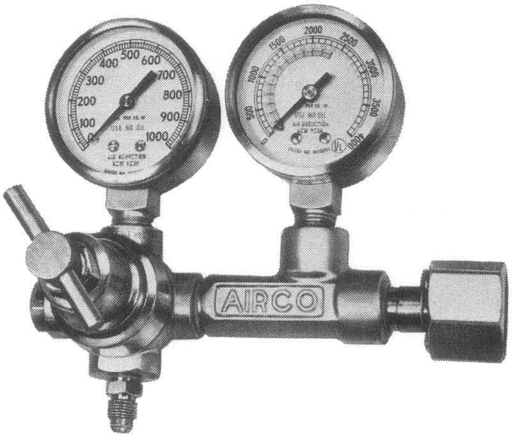
Gas Service	Stock Number	1½" PSIG Pressure Gauges	Maximum Delivery		Connections	
			Flow (CFH)	Pressure (PSIG)	Inlet	Outlet
Nitrogen Oxygen Argon Helium Hydrogen Forming Gas (Hyd.-Nit. Mixture)	806-9070	100	425 (AIR)	40	1/4" N.P.T. Int	1/4" N.P.T. Int.

FOR INSTRUCTIONS, SEE ADI-1531

1100 SERIES SINGLE-STAGE CYLINDER REGULATORS LOW-FLOW

Low and High Pressure Regulators for Laboratory Use





Airco 1100 Series Regulator provides reliable gas delivery control for a wide variety of gases including oxygen, hydrogen, w.p. nitrogen, nitrogen o.p. and helium. Both low-pressure, and high-pressure models are available. These regulators maintain accurate, fixed pressures in closed systems requiring comparatively low gas flow.

The 1100 Series Regulators are designed specifically for bomb calorimetry, high-pressure hydrogenation, accelerated age testing, catalytic reduction, bubbling operations and maintaining special atmospheres.

DESIGN ADVANTAGES

- Airco 1100 Series Regulators features a safety release on the low pressure side, except for those regulators with a maximum working pressure of 1,000 psi.

- All regulators with a maximum working pressure of 45 psi or less, have an outlet needle valve for "A" size RH and LH hose connections.

- The outlet of the high pressure models is fitted with 3/16" copper tubing with a Parker fitting having 1/8" male pipe thread.

The table below should be used to choose the proper regulator.

The Flow Capacity Curve indicate the maximum flow rate, at a given pressure that can be obtained from each regulator. Flows shown on the graph are based on reasonable pressure drops in the delivery system and relatively low cylinder end points. Higher than indicated flows are possible if a greater pressure drop in the delivery system, and a higher cylinder end point can be tolerated. Plot points identified by regulator stock numbers represent flows at maximum working pressures.

Series 1100 Low-Flow/Low-Pressure Regulators

Gas Service	Stock Number	2" P.S.I. Pressure Gauges	Maximum Delivery			Connections	
			Flow (CFH)	Pressure (P.S.I.)	CGA No.	Inlet	Outlet
Oxygen	806-1101	60 & 4000	170	45	540	.908"—14 R.H. Int.	Needle Valve "A" R.H. Ext.
Oxygen	806-1151	60 only	170	45	540	.908"—14 R.H. Int.	Needle Valve "A" R.H. Ext.
Hydrogen	806-1103	60 & 4000	650	45	350	.830"—14 L.H. Int.	Needle Valve "A" L.H. Ext.
W.P. Nitrogen	806-1108	60 & 4000	170	45	580	.960"—14 R.H. Ext.	Needle Valve "A" R.H. Ext.
Nitrogen O.P.	806-1124	60 & 4000	170	45	550	.908"—14 L.H. Int.	Needle Valve "A" L.H. Ext.
Nitrogen O.P.	806-1174	60 only	170	45	550	.908"—14 L.H. Int.	Needle Valve "A" L.H. Ext.

FOR INSTRUCTIONS AND PARTS, SEE ADI-800

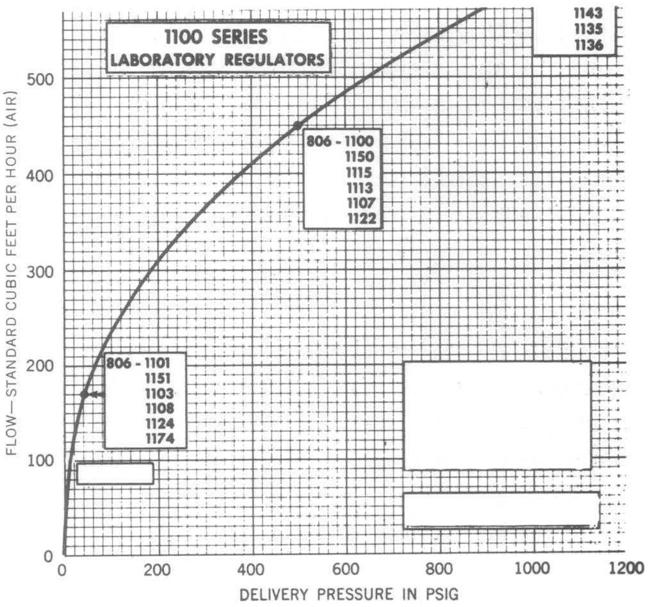
Series 1100 Low-Flow/High-Pressure Regulators

Gas Service	Stock Number	2" P.S.I. Pressure Gauges	Maximum Delivery Flow (CFH)	Maximum Delivery Pressure (P.S.I.)	CGA No.	Connections Inlet	Connections Outlet
Oxygen	806-1100	1000 & 4000	450	500	540	.908"—14 R.H. Int.	Parker* Fitting
Oxygen	806-1150	1000 Only	450	500	540	.908"—14 R.H. Int.	Parker* Fitting
Oxygen	806-1130	1500 & 4000	600	1000	540	.908"—14 R.H. Int.	Parker* Fitting
Helium	806-1115	10000 & 400	1220	500	350	.830"—14 L.H. Int.	Parker* Fitting
Hydrogen	806-1113	1000 & 4000	1700	500	350	.830"—14 L.H. Int.	Parker* Fitting
Hydrogen	806-1143	1500 & 4000	2280	1000	350	.830"—14 L.H. Int.	Parker* Fitting
W.P. Nitrogen	806-1107	1000 & 4000	450	500	580	.960"—14 R.H. Ext	Parker* Fitting
W.P. Nitrogen	806-1135	1500 & 4000	600	1000	580	.960"—14 R.H. Ext.	Parker* Fitting
Nitrogen O.P.	806-1122	1000 & 4000	450	500	550	.908"—14 L.H. Int.	Parker* Fitting
Nitrogen O.P.	806-1136	1500 & 4000	600	1000	550	.908"—14 L.H. Int.	Parker* Fitting

*Supplied with 3/16" Flexible Copper Tubing 36" long with Parker Fitting which fits 1/8" female pipe tread.

Flows on the curve are based on *air* flow, and must be converted to give the flow for the *actual service gas*. This is done by multiplying the maximum flow derived from the curve by one of the appropriate factors listed below:

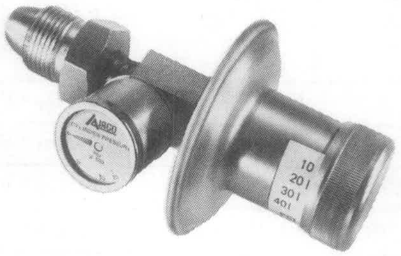
GAS SERVICE	FACTOR
Oxygen	.95
Hydrogen	3.79
Nitrogen	1.02
Helium	2.7



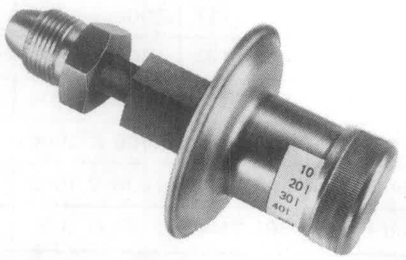
7200 SERIES- WITH 2500 PSI H.P. GAUGE
7300 SERIES-GAUGELESS
ALL-WELDED, STAINLESS STEEL CYLINDER REGULATORS

Specifically Designed For Research Grade & Ultra High Purity Gas Service

7200 SERIES



7300 SERIES



Research and medical grade gases must meet the most demanding purity requirements. However, these expansive gases are contaminated easily during distribution. The conventional regulator is a major source of this contamination. The regulators are ideal for use in crystal growing, heat treating, semi-conductor doping gas applications, preparing inerting atmospheres for lamp filling and gas chromotography.

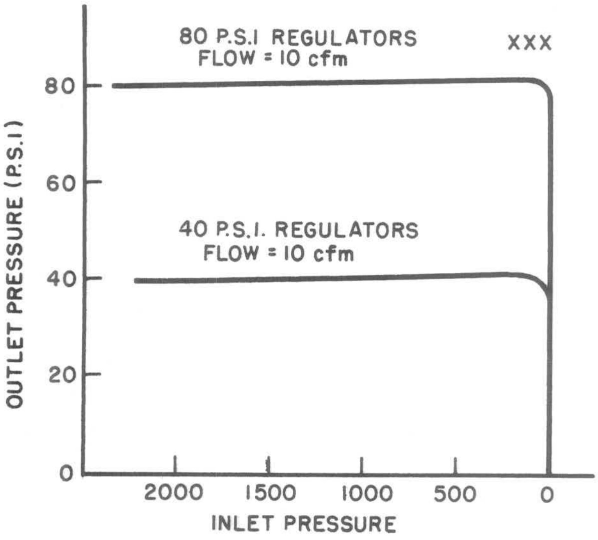
Airco's all-welded stainless steel cylinder regulators with stainless steel body and diaphragm, are designed specifically for ultra high purity gas service. They are available with 2500 p.s.i. high pressure gauge (7200 series) or gaugeless (7300 series). All joints between the gas passages in the regulator and the outside atmosphere are fusion welded. There is no possibility of contamination from outside sources through leaking joints. The gas, in its passage through the regulator, is exposed only to stainless steel, a monel pin and a teflon seat. A specially constructed isolated cylinder contents gauge eliminates the always difficult job of evacuating a Bourdon tube. All elements of the seating mechanism can be removed through the inlet gland. Although this is a sealed regulator it is easily maintained.

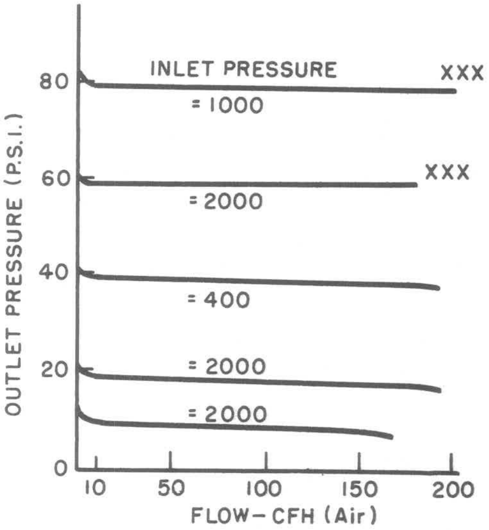
These regulators are all helium inboard-leakage-rate-tested to 4 x 10—10 cc/sec.

SPECIFICATIONS

Gas Service	Stock Number		Max. Delivery			Connections	
	With 2500 P.S.I. H.P. Gauge	Gaugeless	Flow (CFH)	Press. (PSIG)	CGA No.	Inlet	Outlet
Doping Gases** Helium Hydrogen	806-7203	806-7303	150 (AIR)	40	350	.830"—14 L.H. Int.	1/4" O.D.S.S. Tube
Oxygen	806-7206	806-7306	150 (AIR)	40	540	.908"—14 R.H. Int.	1/4" O.D.S.S. Tube
Argon, Helium, Krypton Nitrogen, Neon, Xenon	806-7207	806-7307	150 (AIR)	40	590	.960"—14 L.H. Ext.	1/4" O.D.S.S. Tube
Argon, Helium*, Krypton* Nitrogen*. Neon*. Xenon*	806-7208	806-7308	150 (AIR)	40	590	.960"—14 L.Y. Ext.	1/4" O.D.S.S. Tube
Doping Gas Hydrogen, Helium	806-7213	806-7313	150 (AIR)	80	350	.830"—14 L.H. Int.	1/4" O.D.S.S. Tube
Argon, Helium, Krypton, Nitrogen, Neon, Xenon	806-7217	806-7317	150 (AIR)	80	590	.960"—14 L.H. Ext	1/4" O.D.S.S. Tube
Argon, Helium*, Krypton* Nitrogen*, Neon*, Xenon*	806-7218	806-7318	150 (AIR)	80	580	.960"—14 R.H. Ext	1/4" O.D.S.S. Tube

**Doping Gases (Arsine, Silane, Diborane, Phosphine with Argon, Helium, Hydrogen, Nitrogen)
*Fits STD C.G.A. Cylinder





Both 40 & 80 p.s.i. Models
Perform identically
Below 40 p.s.i. Delivery Pressure

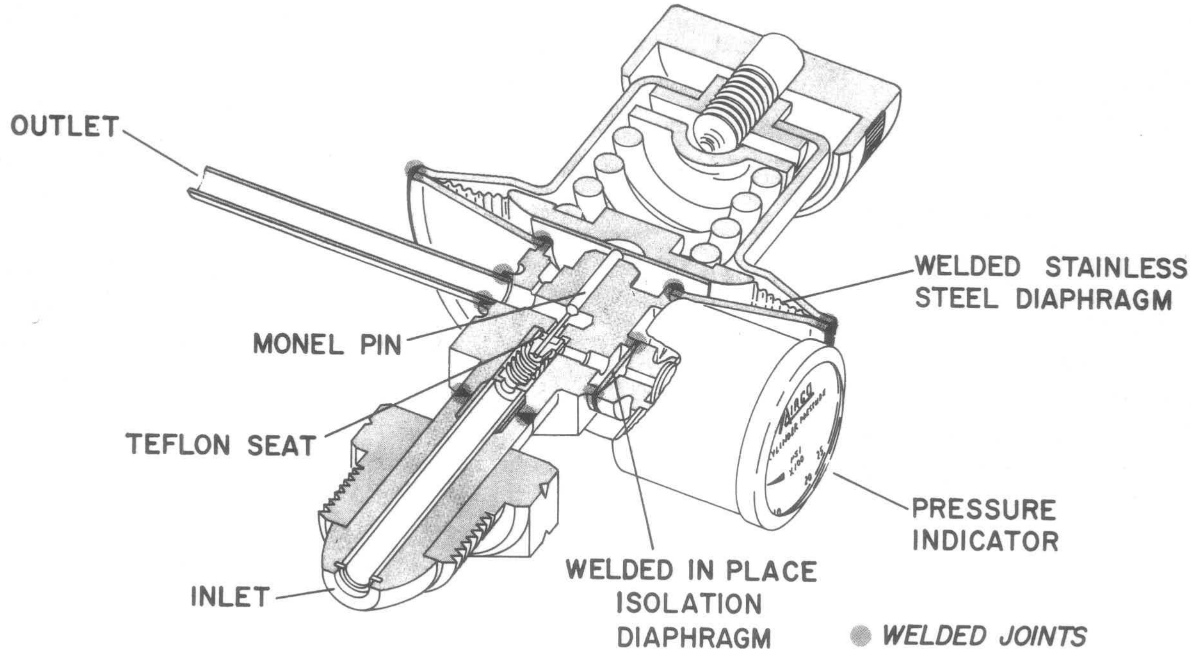
XXX Curves for 80 p.s.i. model only

EXCELLENT PRESSURE REGULATION

The outlet pressure varies less than 3 psi with a 2400 p.s.i. drop in inlet pressure as gas is withdrawn from the cylinder.

EXCELLENT FLOW REGULATION

The outlet pressure drops less than 3 p.s.i. as the flow is increased from 0 to 150 CFH.



MODEL 30 CYLINDER REGULATOR, HI-PRESSURE HI-FLOW

For Use With 6000 PSI Nitrogen, Helium, Argon

The Airco Model 30 High-Pressure, High-Flow Regulator is designed for precise, safe flow control of nitrogen, helium and argon from 6000 p.s.i. cylinders.

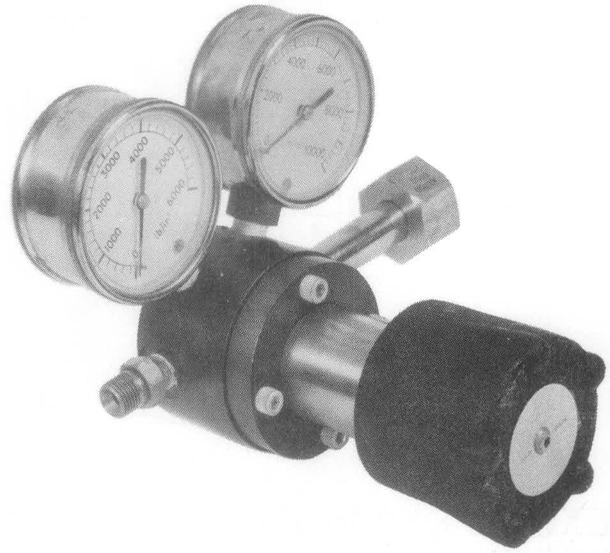
Flow capacity and accuracy are provided by the use of a balanced seat design. Pre-set regulated outlet pressures are not significantly affected by fluctuating inlet pressures.

TYPICAL APPLICATIONS

- Pressurization of airborne accumulators and cryostat systems.
- Simulation of pressure conditions encountered in missile and rocket operations.
- Missile component checkout.
- Acceptance testing of equipment and parts designed for extreme operating conditions.
- Line pressurization and system purging.
- Auxiliary braking of jet aircraft.
- Soldering, brazing and pressure bonding of metals without flux.
- Maintaining storage bottles.

An integral relief valve allows automatic bleed-down when the outlet pressure is reduced.

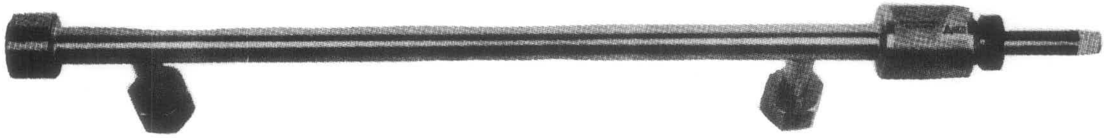
Model 30 makes it ideal for use with manifold-mounted 6000 p.s.i. cylinders. Maximum flow is obtained at sonic velocity with the regulator full open and is defined as the flow factor. Flow factor — .13. Sonic velocity is achieved when the outlet pressure approximates 50% of the inlet pressure. To determine approximate maximum rated flow at sonic velocity, multiply the flow factor times the inlet pressure to obtain flow in SCFM.



Airco's high-pressure manifold is designed for use with 6000 p.s.i. cylinders. It reduces the cost of handling individual cylinders and provides high volume flows.

The 6000 p.s.i. manifold is constructed entirely of 300 Series stainless steel. It is designed for dual cylinder applications, with 16-inch cylinder spacing and 1/4-inch NPT male outlet fittings. All weld joints are of the aircraft-approved type, and are radiographically inspected. Airco's 6000 p.s.i. manifold is proof tested with gas at 10,000 p.s.i. and carries a burst pressure rating of 24,000 p.s.i.

6000 PSI STAINLESS STEEL MANIFOLD



Gas Service	Stock Number	2½" Gauges	MAXIMUM DELIVERY		CONNECTIONS	
			FLOW (SCFH)	PRESSURE (PSIG)	Inlet	Outlet
Nitrogen Helium Argon	806-0030	Del. Gauge: 0-6,000 psig Cyl. Gauge: 0-10,000 psig	46,000 (AIR)	5000	1.035"- 14 NGO L.H. Int.	1/4" NPT Int.

FOR INSTRUCTIONS AND PARTS, SEE ADI-1572

LESSON PLAN

SUBJECT: TRANSFER LEARNING INTO SELLING—1

OBJECTIVE: To stress how the material learned can be applied to selling.

METHOD: Group Discussion.

REFERENCE: Product Information Class 8 Text
SECTION A: Combustion Theory
SECTION B: Gas Supply Systems
SECTION C: Gas Regulators
SECTION D: The Airco Regulator Line

TRAINING MATERIALS: Note Taking Sheet on Transfer Learning into Selling — 1
For Sections A, B, C and D.

PRESENTATION:

This group discussion has been incorporated in the program to help you transfer today's learning material into selling Class 8 products.

There is no set plan of direction for this discussion because of individual differences and experiences.

What we are looking for is a sharing of *sales* experiences and an exchange of *ideas*.

Everyone will benefit because after this discussion, you will determine a positive selling plan by recording pertinent information relating to your accounts. Refer to your note taking sheets on SECTIONS A, B, C and D.

REFER TO NOTE TAKING SHEET ON SECTION A, B, C & D.

Now that we have reviewed the Gases, various Supply Systems, and Regulating Equipment, how will it help you in a selling situation?

To get you started, here is an example of an actual sales experience by a salesman: "An account in a large city complained about having to change 20 oxygen cylinders each day. The Distributor's delivery truck had a difficult time because of lack of parking facilities; the customer only had one doorway; and the truck driver would spend 1-1/2 to 2 hours just delivering cylinders.

They would be taking 20 cylinders from the manifold and replacing them. While I was there, I said to them that I had a liquid Kryo-Flow system; that for every 20 cylinders he used, he would only need one liquid cylinder.

Well, it wound up that we converted him from high pressure cylinder oxygen to liquid oxygen. I then suggested he pipe the plant for a better distribution system. Therefore, we sold them pipeline regulators, the 9900 Series and station valves."

Now let us have your *sales* experiences.

AFTER A SHARING OF SALES EXPERIENCES ASK FOR AN EXCHANGE OF IDEAS.

Now that we have shared sales experiences, let us exchange *ideas* to get you started. Here is a typical idea:

For example, a customer wants to do a large heating job. We know that unless he manifolds cylinders he is going to be in trouble because of withdrawal rates. We use as a rule of thumb 50 cubic-feet per-hour fuel withdrawal. For every 50 cubic-feet-per-hour he must use another cylinder. What happens if he doesn't have an adequate manifold? When he lights the torch and sets his flame properly, he cannot supply enough fuel to the torch. Then what happens?

The flame starts to oxidize and before you know it he can melt off the end of the tip. So, knowing the burning velocity of the gases and the withdrawal rates from cylinders enables you to recognize a sale of a manifold system.

Now let us have your ideas.

CONCLUSION:
TRAINER SUM UP POINTS COVERED. EACH PARTICIPANT SHOULD HAVE WRITTEN NOTES UNDER SALES EXPERIENCES AND IDEAS, LISTING THE NAME OF THEIR ACCOUNTS THAT CAME TO MIND.

TRANSFER LEARNING INTO SELLING—1
NOTE TAKING
GROUP DISCUSSION

SECTION A. — COMBUSTION THEORY

SECTION B. — GAS SUPPLY SYSTEMS

SECTION C. — GAS REGULATORS

SECTION D. — THE AIRCO REGULATOR LINE

SALES EXPERIENCES

NAME YOUR ACCOUNTS
THAT COME TO MIND

NAME YOUR ACCOUNTS
THAT COME TO MIND

IDEAS

LESSON PLAN

SUBJECT: HOMEWORK ASSIGNMENT

OBJECTIVE: To have the participant read the more detailed material in the Product Information — Class 8 Test.

REFERENCE: Product Information Class 8 Test.

TRAINING MATERIALS: SECTIONS A, B, C, and D — Combustion Theory; Gas Supply Systems; Gas Regulators; The Airco Regulator Line.

PRESENTATION:

The homework assignment is to read the detailed material in the Product Information Class 8 Text Sections A, B, C, and D.

Tomorrow's class will begin with a test on the material presented in class today. The test will not cover the detailed homework assignment, the video tapes, or any demonstrations.

AGENDA

SECOND DAY/A.M.

8:30 — 9:00
TEST, Score your own Test.

9:00 — 9:30
STUDY TIME for review of material not understood.

9:30 — 10:00
SECOND E: HOSE AND CONNECTIONS

10:00 — 10:30
COFFEE BREAK — Viewing Video Tape No. 8 Flame Cutting, Piercing, Beveling, MAPP Gas Series.

10:30 — 12:00
SECTION F: TORCHES

12:00 — 1:00
LUNCH

SECOND DAY/P.M.

1:00 — 2:00
SECTION G: TORCH TIPS AND APPLICATIONS

2:00 — 3:00
SECTION H: WELDING AND CUTTING OUTFITS

3:00 — 3:15
COFFEE BREAK — Viewing Video Tape No. 10 Welding, Braze Welding, Silver Brazing MAPP Gas Series.

3:15 — 4:00
SECTION H: WELDING AND CUTTING OUTFITS Continued.

4:00 — 4:30
GROUP DISCUSSION — TRANSFER LEARNING INTO SELLING — 2

4:30 —
HOMEWORK ASSIGNMENT —
Review Text

Section E: Hose and Connections
Section F: Torches
Section G: Torch Tips and Applications
Section H: Welding and Cutting Outfits
Glossary of Terms
Study for test on material presented in class (except Video Tape).

LESSON PLAN

SUBJECT: ADMINISTERING TESTS

OBJECTIVE: To determine if the participant understood the material presented in the first day. Everyone should achieve 100%.

METHOD: Written Tests.

REFERENCES: Product Information Class 8 Text.

TRAINING MATERIALS: Tests and answers on SECTIONS A, B, C, and D.
Second Day material includes SECTIONS E, F, G, H, and
Transfer Learning Into Selling—2
Glossary of Terms

PRESENTATION:

We will now have a written test on Sections A, B, C, and D, Combustion Theory, Gas Supply Systems, Gas Regulators and The Airco Regulator Line. We are striving for complete understanding of the material. We hope that everyone will achieve 100%.

After you have taken the test, you are to check your answers with the answers given on the pages following the tests.

Keep your own score. Just count the number right and the number wrong in each section.

TRAINER:
NOW TURN TO LESSON PLAN ON *STUDY TIME* WHICH FOLLOWS THE TEST ANSWERS.

TEST
SECTION A. COMBUSTION THEORY

DIRECTIONS: Answer all questions and grade your own paper. We are striving for complete (100%) understanding of all material.

1. Name the four most commonly used fuels?

   a. b. c. d.

2. Fuel is energy measured in?

   ______________________________ (_____)

3. Which fuel gas when combined with oxygen creates the highest flame temperature at the primary zone?______________________.

4. A reaction that absorbs heat is called endothermic. (True/False).

5. In most oxy-fuel applications the goal is to rapidly transfer the ____________ to the ______________.

6. The gas flow velocity should be (more/less) than the burning velocity to obtain a stable flame.

TEST
SECTION B. GAS SUPPLY SYSTEMS

DIRECTIONS: Answer all questions and grade your own paper. We are striving for complete (100%) understanding of all material.

1. The color code is one way to determine the gas contained in a cylinder. What is the other method? ____________.

2. CGA means (________________ _____ ____________________).

3. Is the pressure the same in an oxygen cylinder regardless of size? (Yes/No.)

4. What would change the pressure in an oxygen cylinder? _____________.

5. As oxygen is being withdrawn from the cylinder, the contents remaining can be determined by the ____________ ______________.

6. The agency that establishes rules for the safe storage of cylinder is called ______________ _________ ___ ________ ____________________.

7. In an acetylene cylinder, acetylene is absorbed by _______________.

8. The acetylene cylinder content should not be discharged at a continuous rate exceeding 50 cubic feet per hour from a 275 cubic feet cylinder. (True/False)

9. Acetylene cylinder valve have a knob that can be turned by hand. (True/False)

10. The purpose of manifold is to provide a large _________________ of gas from a number of cylinders.

11. There are two types of manifolds: one is stationary, the other ____________.

12. There are two types of modular manifolds in the stationary system:
    1.______________________ 2.______________________.

TEST
SECTION C. GAS REGULATOR

DIRECTIONS: Answer all questions and grade your own paper. We are striving for complete (100%) understanding of all material.

1. A regulator reduces cylinder pressure to ____________________ pressure.

2. The maximum allowable pressure for working with acetylene is 15 p.s.i. (True/False)

3. An oxygen regulator (Can/Cannot) be used for acetylene or any other gas.

4. The high pressure gauge for oxygen can register up to ____________________ p.s.i., but the actual maximum pressure in the cylinder will be ____________ p.s.i.

5. Match the following regulator terms on the left with the definitions on the right:

______a. Static Increment	1. regulator ceases to function
______b. End-point	2. pressure rise on regulator when equipment is shut
______c. Creep	3. cylinder pressure causes high heat when opened
______d. Seat ignition	4. a leak into the delivery side of the regulator

6. Fuel gas regulators do not have a safety relief valve. (True/False)

TEST
SECTION D. THE AIRCO REGULATOR LINE

DIRECTIONS: Answer all questions and grade your own paper. We are striving for complete (100%) understanding of all material.

1. Airco single-stage regulators have a ________________ (direct/inverse) valve seat.

2. Airco two-stage regulators have a ______________(direct/inverse) valve seat in the first stage and a ______________(direct/inverse) valve seat in the second-stage.

3. The most popular Airco single-stage regulator series is the __________.

4. An inverse seat provides a slightly rising delivery as cylinder pressure falls. (True/False).

5. The Airco 9100 Series regulators feature a seat assembly and a _______________ diaphragm.

APPLIED EXERCISE:

TWO-STAGE REGULATOR
COMPARISON WITH COMPETITION

Given the AIRCO feature, place the appropriate benefit in the column marked BENEFIT. Given the competitive feature, place the appropriate short coming in the column marked SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	FEATURE	SHORTCOMING	FEATURE
	Combination direct and inverse seat		Both stages are inverse
	Gauges face 90° from adjusting screw		Gauges face the operator
	Safety relief valve discharges downward		Rupturing of the diaphragm

ANSWERS
SECTION A. COMBUSTION THEORY

1. a. Acetylene b. Natural Gas c. Propane d. MAPP Gas
2. British Thermal Unit (B.T.U.)
3. Acetylene
4. True
5. Heat, Work
6. Less

ANSWERS
SECTION B. GAS SUPPLY SYSTEMS

1. Decal
2. Compressed Gas Association
3. Yes
4. Temperature
5. Gauge Pressure
6. National Board of Fire Underwriters
7. Acetone
8. True
9. False
10. Volume or amount
11. Portable
12. Simplex, Duplex

ANSWERS
SECTION C. GAS REGULATORS

1. Working

2. True

3. Cannot

4. 4,000 p.s.i., 2200 p.s.i.

5. 2 a. 1 b. 4 c. 3 d.

6. True

ANSWERS
SECTION D. THE AIRCO REGULATOR LINE

1. Inverse
2. Direct, Inverse
3. 9100
4. True
5. Neoprene

TWO-STAGE REGULATOR COMPARISON WITH COMPETITION

AIRCO		COMPETITION	
FEATURE	**BENEFIT**	**FEATURE**	**SHORTCOMING**
1. Combination direct and inverse seat	No pressure change No operator adjustment	Both stages are inverse	Rising pressure requires operator adjustment
2. Gauges are faced 90° away from adjusting screw High pressure gauge is shielded by low pressure gauge	Minimizes chance of operator injury In case of rupture flying parts are deflected	Gauges face the operator High pressure gauge is not shielded	More prone to injury Flying parts not deflected
3. Safety relief valve discharges downward	If regulator is over pressurized and discharges, it will not harm operator	Some do not have relief valve, rely on rupturing of the diaphragm	Gas exhausts through the face of the spring case into the operator's face
4. The cylinder nut retaining ring	Protects the gland sealing surface from damage	Cylinder nut is loose and slides down	Exposes the gland and can be damaged easily

LESSON PLAN

SUBJECT:	STUDY TIME — SECOND DAY
OBJECTIVE:	To review material that has not been understood by forming groups to meet individual needs.
METHOD:	Special Group Formation.
REFERENCES:	Product Information Class 8 Section A,B,C, and D.
TRAINING MATERIALS:	Tests and answers to SECTIONS A, B, C, and D.

PRESENTATION:

We will briefly review the answers to the test and help clarify material that has not been understood.

AFTER CLARIFICATION OF INFORMATION

To give each of you time to review material not understood, we will call this portion of the program STUDY TIME. The Study Time will last 30 minutes. There will be four groups formed. A group leader will be chosen for each group.

THE GROUP FORMATION WILL VARY ACCORDING TO THE NUMBER OF PARTICIPANTS AND THEIR UNDERSTANDING OF THE MATERIAL.

FOR EXAMPLE:

1. THREE GROUPS—MATERIAL
   ONE GROUP—PRESENTATIONS
2. ONE GROUP—MATERIAL
   TWO GROUPS—PRESENTATIONS
3. OR ANY OTHER COMBINATION
   WHICH MAY BE MORE FEASIBLE

Group 1—Review Section A, Combustion Theory.

Group 2—Review Section B, Gas Supply Systems.

Group 3—Review Section C — D, Regulators and Airco Regulators.

Group 4—Presentations—

a. This group is for participants who fully understand all the material.

   Each participant in this group 4 will be given a topic to present which will be related to the material covered on the previous day.

   If you achieved 100% in each section on the test, join Group 4 Presentations during this study time.

TRAINER:
SELECT A LEADER FOR GROUP 1, 2, 3 AND 4 ASSIGN SUBJECT TO PARTICIPANTS IN GROUP 4 PRESENTATIONS

By checking your score, you can determine which group to join for reinforcement of the material in which you need more time to study.

TRAINER:
ROTATE FROM GROUP TO GROUP

If you did not achieve 100% in one Section or two Sections, join the group during study time which will help meet your individual need. You can move from one group to another. After you clarify all the information, if there is sufficient time remaining move into Group 4 — Presentations.

CONCLUSION:
IF THERE ARE ANY POINTS YOU PICKED UP DURING THIS STUDY TIME, DISCUSS IT.

We will select a leader for each Group. Those of you who will join Group 4, you will have 10 minutes to prepare and 3 minutes to present an assigned subject.

LESSON PLAN

SUBJECT:	SECTION E: HOSES AND CONNECTIONS
OBJECTIVE:	To have participant understand the role of hoses and connections. To acquaint participant with Airco's Hose and Connection Product Line.
REFERENCES:	Product Information Class 8 Text Section E: Hoses and Connections
TRAINING MATERIALS:	Section E: Hoses and Connections Slides E-1, E-2 Projector Screen

PRESENTATION

I. PRESSURE DROP

A. Lack of gas flow causes most trouble
  1. Poor performance
  2. Flashback
  3. Burnback
  4. Equipment damage

B. Causes of low gas flow
  1. Insufficient pressure at the source of supply
  2. Demand exceeds the rate of fuel released from a cylinder
  3. Hose — condition, length, size — too small causes gas friction
  4. Restrictions in the fittings

II. TORCH ENTRY PRESSURES

1. Drops below regulator pressure when gas flows.
2. In order to maintain adequate torch entry pressure, set the regulator pressure higher according to the charts.

SEE CHART IN SECTION E: HOSES AND CONNECTIONS, PAGE E-8

For example:
Hose diameter 3/16"
Flows CFH—50
Torch Entry Pressure — 60
Set Regulator pressure to — 63

III. AIRCO HOSE

1. Three grades — R, RM, M
   a. Grade R—rubber inner tube and cover classified as "non-oil and fire resistant."
   b. Grade RM—rubber inner tube, neoprene cover "non-oil and fire resistant internally" with "oil and fire resistant" cover.
   c. Grade M—neoprene inner tube and cover, classified as "oil and fire resistant."

2. Airco twin hose is grade RM (green for oxygen, red for fuel gases)
    a. Quality construction
        1. Formed and vulcanized in a precision machined plattern press mold
        2. Maximum web strength and hose flexibility
        3. Exceptionally close and tight braid
        4. Uniform inner hose diameters

Slide E-1 BRAID OF AIRCO TWIN HOSE VERSUS COMPETITOR

Slide E-2 INNER HOSE DIAMETER VERSUS COMPETITOR

3. Airco single line hose
    a. Grade R
    b. Meets or exceeds requirements for RMA-CGA specifications
    c. Quality construction
        1. Tube-non-porous smooth inner surface, will not shed or flake
        2. Carcass — braided, burst strength is four times the maximum working pressure
        3. Corrugated cover — ribbed cover, resists abrasions; heat resisting compound

SEE GAS HOSE CONNECTIONS AT END OF SECTION E: TEXT MATERIAL, PAGE E-13

IV. HOSE CONNECTIONS

Hose Connection—standardized for the oxy-fuel industry to permit interchanging various makes of equipment.

A. Nuts and Glands
    1. Gland— basic element
    2. Nuts—must be used with gland to connect to regulator or torch handle

B. Hose connection nipples
    1. Part of the regulator and torch handle where hoses are connected

C. Hose Coupling
    1. Used to connect lengths of hose

D. Hose—splicing nipple
    1. Used to splice lengths of hose which will not be separated

E. Ferrule
    1. The end of a new hose has a ferrule —crimped by machine to provide a good, tight connection

F. Hose clamps
   1. Used in the field when crimping is not available
   2. Mechanical means of clamping where a connection is made

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION E
HOSES AND CONNECTIONS

1. Pressure Drop
2. Torch Entry Pressures
3. Airco Twin Hose
4. Airco Single-Line Hose

1. GENERAL CONSIDERATIONS ON PRESSURE DROPS

The most trouble that inexperienced operators encounter in oxy-fuel work is caused by insufficient amount of gas flow. This results in poor equipment performance, loss of time and flashback or burnback, when welding or heating which may damage the equipment. It is important to understand the cause of low gas flows.

CAUSES OF LOW FLOW

1. In some cases, it is due to insufficient pressure at the source of supply (cylinder or pipeline).

2. It also can be that the demand exceeds the rate of fuel released from a cylinder.

3. Another very common reason is the hose condition and the gas friction against the wall of the hose i.e., the hose size is often too small for the required flow.

4. It has restrictions in the fittings — the most common restrictions are connection glands or coupling fittings with non-standard, small flow passages. All these result in reduced pressure at the torch entry.

PRESSURE DROP

For a given hose size, as the gas flow demand increases, the pressure drop through the hose increases. When a given gas pressure is set at a regulator and the torch is shut off, the pressure at the torch is equal to the pressure on the regulator gauge. When the torch valves are open and the gases flow from the torch, the gas pressures at hose exit or torch entry drop below the regulator pressure and stabilize. If the hoses are short or their inside diameter is adequate for the length used, the pressure loss at torch will be minimal, for most common operations. But when large flows for heavy cutting or heating are involved, it is a good practice to place a set of test gauges (Airco stock numbers: oxygen 831 2840 fuel 831 2841) between the torch and the hoses. If torch-mounted check valves are used, mount the gauges between the torch and the check valves. The gauge shows the pressure at torch entry. The gas pressure regulators should be adjusted so the pressure reading on the test gauge (mounted at torch entry), with torch valves open and gas flowing shows the recommended pressure for the particular operation.

Gauges are not always available. And using gauges at torch entry is done only when an operation is critical or when setting up for a substantial time. In most cases an experienced operator will "eye ball" a situation (i.e., hose length and condition, number of check valves, type and condition of fittings . . .all of which will affect flow at the torch) and adjust the regulator pressure accordingly.

In general gas pressure drops through hoses depend on the flow rates and operating pressures. The following tables are for reference to guide the user in selecting the proper hose to do a job.

Knowing the approximate hourly flow rate and the torch entry operating pressure to do a given job, the table shows the regulator pressure needed at the hose entry.

2. TORCH ENTRY PRESSURES VERSUS REGULATOR PRESSURE SETTING

HOSE DIAMETER — 3/16"

25 FEET LENGTH

FLOWS CFH	TORCH ENTRY PRESSURES–P.S.I.								
	20	30	40	50	60	70	80	90	100
50	23	33	43	53	63	73			
75	25	35	45	55	65	75			
100	28	37	46	56	66	76			
150	33	41	48	57	67	77			
250	46	52	58	67	74	84			
350	59	63	68	75	84	91			
500	82	85	89	94	99	105			

REGULATOR PRESSURE SETTINGS

HOSE DIAMETER — 1/4"

25 FEET LENGTH

FLOWS CFH	TORCH ENTRY PRESSURES–P.S.I.								
	20	30	40	50	60	70	80	90	100
100	22	32	42	52	63	73	83	95	103
250	27	36	45	55	65	75	84	94	104
500	36	44	53	61	70	79	89	98	108
1000	76	78	82	86	91	97	104	111	118

REGULATOR PRESSURE SETTINGS

HOSE DIAMETER — 5/16"

25 FEET LENGTH

FLOWS CFH	TORCH ENTRY PRESSURES								
	20	30	40	50	60	70	80	90	100
100	20	30	41	52	62	72	84	94	105
250	23	34	43	54	64	74	84	94	105
500	30	37	47	56	66	75	85	95	106
1000	47	53	60	67	75	83	92	101	112
1500	68	73	76	82	88	95	103	111	120
2000	94	95	96	100	104	108	—	—	—

REGULATOR PRESSURE SETTINGS

HOSE DIAMETER — 3/8"

25 FEET LENGTH

FLOWS CFH	TORCH ENTRY PRESSURES								
	20	30	40	50	60	70	80	90	100
250	21	31	41	51	62	72	82	92	—
500	24	33	44	53	64	74	83	93	—
1000	33	39	48	58	67	77	86	95	—
2000	57	60	67	74	84	89	96	104	—
3000	92	94	96	100	103	110	112	125	—

REGULATOR PRESSURE SETTINGS

HOSE DIAMETER — 1/2"

25 FEET LENGTH

FLOWS CFH	TORCH ENTRY PRESSURES								
	20	30	40	50	60	70	80	90	100
500	21	31	42	52	62	72	82	93	104
1000	23	34	44	54	64	74	83	94	105
2000	32	41	50	59	68	78	87	97	107
3000	47	51	57	66	75	84	93	102	113
4000	66	69	73	77	83	90	100	110	119
5000	82	84	86	88	92	98	107	117	126

REGULATOR PRESSURE SETTINGS

HOSE FOR WELDING AND CUTTING

Airco markets three grades of hoses, referred as Grade R, RM and M.

Grade R has a rubber inner tube and cover. It is classified as "non oil and fire resistant".

Grade RM has a rubber inner tube and neoprene cover. It is classified as "non oil and fire resistant" internally and with "oil and fire resistant" cover.

Grade M has a neoprene inner tube and cover and is classified as "oil and fire resistant".

Rubber hose deteriorates when exposed to oil. Also, once ignited rubber hose will continue burning. Neoprene is not affected by oil and once ignited a neoprene hose will not continue burning for more than 40 seconds.

Airco twin hoses are grade RM; single-line hose, Grade R.

Single-line, 3/16" Grade M hose is used with air-fuel equipment and 1/8" hose is used with Toteweld Outfits® . Grade M favored in MAPP Gas service because of its greater compatibility with liquid MAPP.

3. AIRCO TWIN HOSE

QUALITY CONSTRUCTION EXTENDS SERVICE LIFE

Airco Twin Welding Hose is actually two lines of hose (green for oxygen and red for fuel gases) formed and vulcanized in a precision machined platen press mold. The size and shape of the connecting fin configuration is therefore precisely controlled to provide maximum web strength and hose flexibility. The vulcanized line will not separate even after prolonged service and flexing.

Rugged Airco twin platen press hose wears hard and requires fewer replacements. . . saves money. Exceeds Rubber Manufacturers Association and Compressed Gas Association (RMA-CGA) specifications — Type VD, Grade RM — for strength and durability.

POROSITY INSPECTION

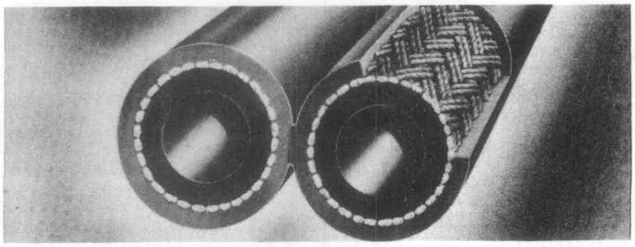
Plate press manufacture provides 100% automatic inspection against porosity in the line. One step in this manufacture is a semi-vulcanization of the inner tube, after the fabric has been put on, but before the outer cover is applied. Semi-vulcanization is induced through the introduction of live stream into the inner tube under high pressure. Any porosity which is present becomes immediately apparent, because the live stream escapes through the porous area.

FABRIC REINFORCEMENT

Airco Twin Hose is also made of specially designed braiding equipment. This braiding equipment produces single braid fabric reinforcement which has the strength of two-braid material, because of its exceptionally close and tight braid. Thus, a more flexible and lighter hose is obtained without sacrifice in strength. This makes possible the use of a thicker cover which gives the hose greater resistance to wear.

TUBE: Will not deteriorate after prolonged use; nonporous compound for safe, dependable operation.

Uniform inner hose diameters assure proper and consistent gas flows for quality welding workmanship.



CARCASS: Woven of twisted rayon cord for unexcelled kink resistance. The shock absorbing capabilities of this tough carcass offer the best resistance to impact, crushing, and to sharp external forces. Bursting pressure strength far exceeds the maximum rated operating pressure thus assuring a high safety margin with Airco Twin Hose.

COVER: A special neoprene compound for maximum resistance to combustion, abrasion, gouging, weathering, and ozone damage. Cover will not break loose or blister in coupling areas even after severe flexing.

EFFORTLESS HANDLING

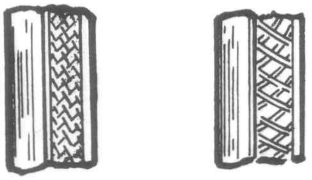
Non-kinking Airco Twin Hose can be attached to welding equipment quickly and easily. Uncoils and stores easily and freely. Welders can change position with complete freedom . . .coil up the hose and move equipment from one location to another with ease.

Uniform inside and outside hose diameters assure perfect coupling fit. Reduces possibility of coupling separation from hose under pressure. Also, consistent inner diameter provides maximum flow which may reduce the size of hose required.

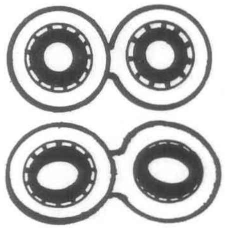
Consistently uniform and concentric inside and outside diameters (30% closer tolerances than industry specifications). No need to carry a stock of oversize and undersize glands and ferrules. Coupling is easier, more dependable, and safer.

COMPARE FLAME RESISTANCE

COMPARE CONSTRUCTION



COMPARE UNIFORMITY



HOW TO ORDER TWIN HOSE

AIRCO Twin Hose is available on 500 foot reels in 3/16-, 1/4-, 5/16-, and 3/8-inch diameters.

HOSE SIZE (500 Ft.)	STOCK NO.	MAX. RECOMMENDED WORKING PRESSURE-P.S.I.
3/16" I.D.	908-4106	200
1/4" I.D.	908-4108	200
5/16" I.D.	908-4110	200
3/8" I.D.	908-4112	200

AIRCO Twin Hose is also available in cut lengths, complete with connections, individually and attractively packaged.

SIZE	STOCK NO.
12½' of 3/16" hose plus A and B conn.	908-0312
25' of 3/16" hose plus A and B conn.	908-0325
50' of 3/16" hose plus A and B conn.	908-0350
50' of 3/16" hose plus B conn.	908-0351
12½' of 3/16" hose plus B conn.	908-0362
25' of 3/16" hose plus B conn.	908-0365
25' of 1/4" hose plus B conn.	908-0425
50' of 1/4" hose plus B conn.	908-0450
100' of 1/4" hose plus B conn.	908-0500
25' of 5/16" hose plus B conn.	908-0575
50' of 5/16" hose plus B conn.	908-0600
100' of 5/16" hose plus B conn.	908-0700
25' of 3/8" hose plus B conn.	908-0825
50' of 3/8" hose plus B conn.	908-0850
75' of 3/8" hose plus B conn.	908-0875
100' of 3/8" hose plus B conn.	908-0900

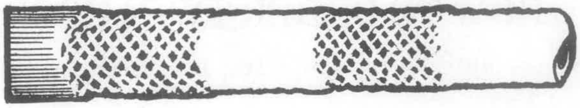
4. AIRCO SINGLE-LINE HOSE

Airco Single-Line Hose, like Airco Twin Hose, is manufactured to exacting standards to meet or exceed the requirements for RMA-CGA specifications. It withstands severe external abuse and still performs safely and efficiently. Meets OSHA requirements.

TUBE: Will not deteriorate after prolonged use, nonporous for safe dependable operation. Smooth inner surface permits full free-flow of gases. Tube will not shed or flake.

CARCASS: Braided construction. Burst strength four times the maximum working pressure. Strong cords are braided under equal tension to make a non-kinking, light, flexible hose which protects against bursting. Thick layer of rubber between braids prevents ply separation — strengthen hose against leaks.

CORRUGATED COVER: Resists the abrasion of sharp metal, grit, dirt. Ribbed cover provides wearing surface for extra long cover life. Heat resisting compound protects hose in accidental contacts with hot pipes or metals. Flexible; retains elasticity, lasts longer.



RED COVER FOR FUEL GASES

GREEN COVER FOR OXYGEN

HOW TO ORDER

AIRCO SINGLE LINE HOSE

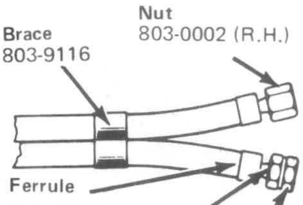
AIRCO Single Line is a reinforced hose which will give long service at low cost. Meets RMA-CGA Specs. For Type S Grade R.

SIZE	STOCK NOS. RED (Acetylene)	STOCK NOS. GREEN (Oxygen)	MAX. RECOMMENDED WORKING PRESSURE-P.S.I.
3/16" I.D. 1 Braid	908-2106	908-3106	250
1/8" I.D. 2 Ply (No Braid)	908-2204	908-3204	200
1/4" I.D. 2 Braid	908-2208	908-3208	250
5/16" I.D. 2 Braid	908-2210	908-3210	250
3/8" I.D. 2 Braid	908-2212	908-3212	250
1/2" I.D. 2 Braid	908-2216	908-3216	200

Single-Line Hose is available on 500 foot reels and as cut lengths.

GAS HOSE CONNECTIONS

"A" SIZE OXY-FUEL

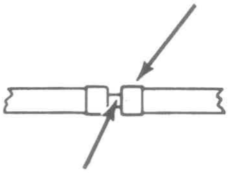

Brace
803-9116

Nut
803-0002 (R.H.)

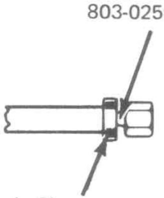
Ferrule
803-9206

3/16" Gland
803-0009

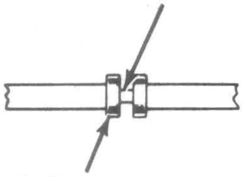
Nut
803-0001 (L.H.)


Ferrule
803-9206

3/16" Splicer
803-0015

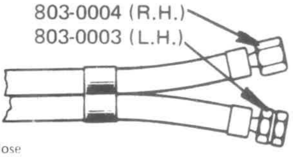

3/16" Gland
803-0259

Circle Clamp
803-0269


3/16" Splicer
803-0264

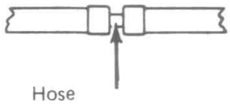
Circle Clamp
803-0269

"B" SIZE OXY-FUEL


803-0004 (R.H.)
803-0003 (L.H.)

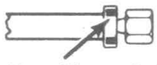
Hose Size		Brace	Ferrule	Gland
3/16"	T or S	803-9116	803-9206	803-0010
1/4"	S	-	803-9208	803-0220
1/4"	T	803-9940	803-9211	803-0220
5/16"	S	-	803-9210	803-0008
5/16"	T	803-8337	803-9208	803-0008
3/8"	S	-	803-9212	803-0014

Hose Splicers with Ferrule



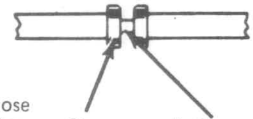
Hose Size	Splicer
3/16"	803-0015
1/4"	803-0221
5/16"	803-7611
3/8"	803-3482

Circle Clamp　Gland


Circle Hose Clamps & Glands

Hose Size	Clamp	Gland
3/16"	803-0269	803-0260
1/4"	803-0270	803-0261
5/16"	803-0271	803-0262
3/8"	803-0286	803-0267

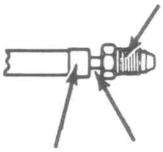
Circle Hose Clamps & Splicers



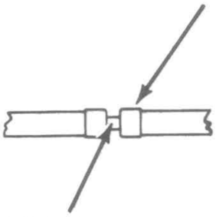
Hose Size	Clamp	Splicer
3/16"	803-0269	803-0264
1/4"	803-0270	803-0265
5/16"	803-0271	803-0266
3/8"	803-0286	803-0268

"A" SIZE INERT GAS

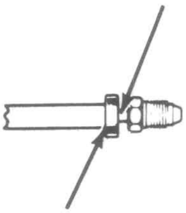
Nut
803-0276 (L.H.)
803-0277 (R.H.)



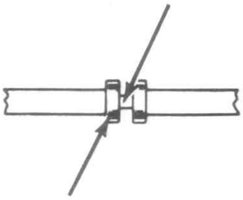
Hose Size	Ferrule	Gland
1/8"	803-9204	803-0272
3/16"	803-9206	803-0273


Ferrule
803-9206

3/16" Splicer
803-0015


3/16" Gland
803-0273

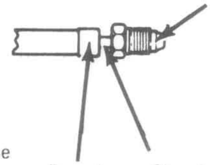
Circle Clamp
803-0269


3/16" Splicer
803-0264

Circle Clamp
803-0269

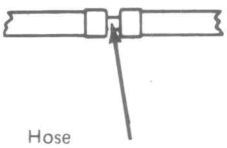
"B" SIZE INERT GAS

803-0254 (L.H.)
803-0255 (R.H.)



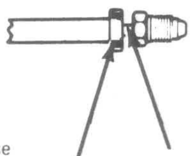
Hose Size	Ferrule	Gland
3/16"	803-9206	803-0245
1/4"	803-9208	803-0246
5/16"	803-9210	803-0247
3/8"	803-9212	803-0248

Hose Splicers with Ferrule



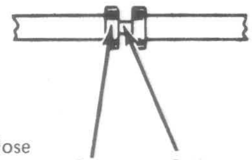
Hose Size	Splicer
3/16"	803-0015
1/4"	803-0221
5/16"	803-7611
3/8"	803-3482

Circle Hose Clamps & Glands



Hose Size	Clamp	Gland
3/16"	803-0269	803-0295
1/4"	803-0270	803-0296
5/16"	803-0271	803-0297
3/8"	803-0286	803-0267

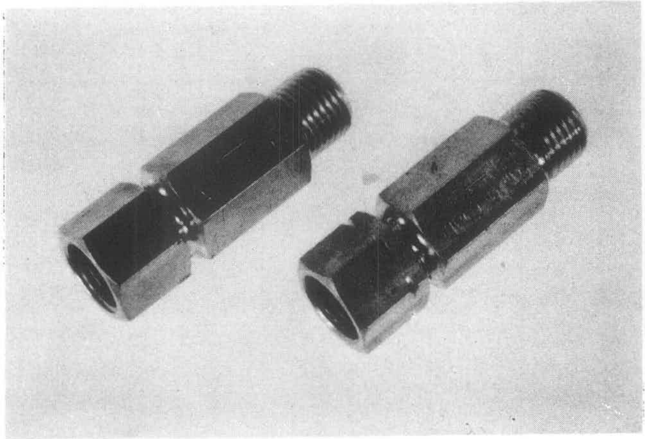
Circle Hose Clamps & Splicers



Hose Size	Clamp	Splicer
3/16"	803-0269	803-0264
1/4"	803-0270	803-0265
5/16"	803-0271	803-0266
3/8"	803-0286	803-0268

CHECK VALVES:

Check valves are important as an accessory to hose, preventing the reverse flow of oxygen into the fuel line and fuel into the oxygen line. Refer to SECTION I: ACCESSORIES for more detail.



REVERSE FLOW CHECK VALVES

LESSON PLAN

SUBJECT: SECTION F: TORCHES

OBJECTIVE:

1. To instruct the participant on the Airco torches used in welding, heating and cutting.
2. To show comparisons of Airco Torches with competition.

REFERENCES: Product Information Class 8 Text
Section F: Torches

TRAINING MATERIALS:

Section F: Torches

Slides F-1—F-17

Projector

Screen

Applied Exercises:

1. WELDING AND HEATING TORCHES COMPARISONS WITH COMPETITION
2. CUTTING TORCH COMPARISONS WITH COMPETITION

PRESENTATION:

I. TORCHES — sometimes called a blowpipe provides a mixture of gases that will produce the flame desired for the particular oxy-fuel processes.

A. In this section we will review the Airco line of torch handles for soldering, brazing, welding, heating and cutting. We will refer to "torch handles" in describing their construction along with those of competitors.

1. "Handles" become torches only after a tip-mixer assembly or mixer and tip are installed.

Slide F-1
AIR FUEL TORCH HANDLE

B. Air fuel torch handle

1. Simplest.
2. Fuel passage through a handle.
3. One end has a valve to connect a hose.
4. The other end accepts a tip or nozzle.
5. Mixing of air with fuel at the tip.
6. Change of tip for the fuel to be used.

C. Torch handles

1. Oxy-fuel welding and heating torches include:
   a. Torch handle
   b. Gas mixer (injector or positive pressure)
   c. Welding or heating tip

Slides F-2, 3, 4, 5
AIRCO TORCH HANDLE
(CUT AWAY PHOTO IN
SUPPLEMENTARY MATERIAL)

2. Airco welding torch handles consist of:
   a. Two gas valves (oxygen and fuel), one rear-end forging, two gas tubes, a front-end or head and the outer handle.
   b. These parts are connected together and the outer handle is slipped over the tubes, and is secured to the rear-end forging and the head.

3. Torch handles do not mix gases. They only provide the final control and adjustment of the flame with the gas valves.

4. The difference in torch handle construction and comparisons with competition is in the means of sealing and attaching the parts.

Slide F-6
AIRCO TORCH HANDLE

5. Comparisons with competition
   a. The Airco torch is all silver-brazed except for the outer handle which is mechanically fastened to the rear-end forging and head. Silver brazed joints can withstand enormous stress without developing leaks. The torch can be subjected to extremely rough treatment and distortion. Therefore, there is less likelihood of downtime due to abuse.

Slide F-7
VICTOR TORCH HANDLE

   b. Other torch handles are mechanically bonded and sealed by means of threads with sealing compound and metal to metal contact, such as the Victor torch handle. The mechanically bonded joints are more sensitive to rough treatment than silver-brazed joints. Therefore, there is more likelihood of downtime due to abuse.
      1. In the Victor torch the handle is a heavy wall tube threaded on both ends to receive the rear-end forging and the head. The oxygen tube is located inside the handle. The handle itself is the fuel tube. Therefore, there is a potential hazard in the event of leakage inside the handle where the oxygen and fuel could mix accidentally.
      2. There is a tapered oxygen tube that is force-fitted into the tapered head. It is questionable whether the two tapered surfaces will continue to seal effectively under the stress of constant usage, or if it has to be taken apart and re-assembled. Therefore, the Victor torch handles are more susceptible to leakage and could cause injury and more downtime due to the need for repair. Also, if the inner tube is installed incorrectly, the head cannot be put on the torch handle assembly.

Slide F-8
HARRIS TORCH HANDLE

3. The Harris torch is a threaded assembly sealed with rubber O-rings. The outer tube or handle serves as the fuel tube. The oxygen tube is internally mounted in the fuel tube (handle). This assembly is prone to leakage once the torch handle assembly is subjected to rough handling and wear.

   The rubber O-rings deteriorate from heat and time. The parts may distort and result in gas leaks.

Slide F-9
SMITH TORCH HANDLE

4. The Smith torch handle is all silver-brazed. However, there are two blind silver-brazed joints within the handle which is also silver-brazed to the rear end forging and head. These blind internal joints are difficult to leak test and therefore, a leaky unit can be sold unnoticed and an accident may occur.

STUDY THE CHART — WELDING AND HEATING TORCH COMPARISONS WITH COMPETITION

The features and benefits of the Airco welding and heating torches versus competition that we have just discussed, appear in a simplified chart which follows.

WELDING AND HEATING TORCHES
COMPARISONS WITH COMPETITION

AIRCO		COMPETITION	
FEATURE	BENEFIT	FEATURE	SHORTCOMING
		VICTOR	
Silver brazed internally	Can withstand stress, no leaks; no downtime	mechanically bonded and use of compound sealer	more sensitive to rough treatment, leaks cause downtime
Mechanically fastened outer handle	easy to repair and inspect		
Two gas tubes in all popular torches	Torch handle does not become a hazard in the hand of an operator	Single tube, the handle is the fuel tube	Torch handle a hazard
		Oxygen tube is force-fitted into a tapered head.	Questionable whether the two surfaces will seal effectively under stress of constant use—more susceptible to leakage. If tube is installed incorrectly, head cannot be put on torch assembly.
		HARRIS	
		Threaded assembly	more susceptible to leakage through rough handling
		Sealed with Rubber O-rings	Deteriorate with heat and time. Metal parts may distort and result in leaks.
		Oxygen tube is internally mounted and the fuel tube is the handle.	Torch handle is a hazard.
		SMITH	
		All silver brazed joints	Although silver brazed joints are more durable than mechanical joints, there are two blind joints which are difficult to leak test therefore a leaky unit can be sold and an accident occur.

II. Cutting Attachment and Cutting Torch

Slides F-10, 11, 12, 13
CUTTING ATTACHMENT
(CUT AWAY PHOTO IN
SUPPLEMENTARY MATERIAL)

- A. A welding torch handle may be fitted with a cutting attachment and tip which makes a cutting torch of the assembly.
    - 1. Attachments are used mainly in service, repair and maintenance trades.

Slides F-14, 15, 16, 17
CUTTING TORCH
(CUT AWAY PHOTO IN
SUPPLEMENTARY MATERIAL)

- B. A cutting torch designed exclusively for cutting is used in the steel fabrication industry where oxy-fuel steel cutting is performed daily.
    - 1. Types—injector or gas premixing torch and the positive pressure torch.
        - a. Injector or gas premixing torch
            - 1. One for low pressure fuel.
            - 2. One for medium pressure fuel. (gas premixing cutting torch modifications are difficult, or often not possible).
        - b. Positive pressure torch
            - 1. Airco tip mixing (mixing of the gases takes place in the tip)
                - a. Simplicity of design can be used with all fuel gases.
                - b. Safety—no flashbacks
                - c. Versatility—can easily be converted to low pressure with an external injector adapter.
                - d. Stainless steel or brass head for ruggedness and economy.

READ AD REPRINT "NOW YOU KNOW HOW TO BUY A BETTER TORCH", IN SUPPLEMENTARY MATERIALS.

- 2. Competition—Premix (mixing of the gases takes place in the torch tube between the handle and the hand).
    - a. Complex design — must change internal assembly to modify for certain gases and applications, or must use another torch.
    - b. Susceptible to flashback damage.
    - c. Limited application — depending on gas used, must change torch and/or mixer (injector).

d. Primarily brass or bronze; (stainless steel is on special order) — less rugged more maintenance.

C. Machine Cutting Torch

1. Although appearing different from the hand cutting torch, machine torches are the same internally.
   - a. Tip mixing
   - b. Simplicity of design
   - c. Safe — no flashbacks
   - d. Versatile
2. Because it is a machine torch, the "head" is internal and made of brass only.
3. Competition — what applies to comparisons in positive pressure hand torches is also true of machine torches.

HAVE EACH PARTICIPANT REFER TO THE APPLIED EXERCISES ON WELDING TORCHES AND CUTTING TORCHES. REVIEW ANSWERS.

We will now take time to complete the applied exercises that appear in Section F. There is one on the welding torch and one on the cutting torch versus competition.

APPLIED EXERCISE

1. WELDING AND HEATING TORCHES
COMPARISONS WITH COMPETITION

Given the Airco features, place the appropriate benefit in the column marked BENEFIT. Given the Competitive feature, place the appropriate shortcoming in the column marked, SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	**FEATURE**	**SHORTCOMING**	**FEATURE**
			VICTOR
	Silver brazed internal parts		mechanically bonded joints with compound sealer.
	mechanically fastened outer handle		single tube, the handle is the fuel tube
	two gas tubes in all popular torches.		oxygen tube is force fitted into the tapered head.
			HARRIS
			threaded assembly
			sealed with rubber O-rings
			oxygen tube is internally mounted and the fuel tube is the handle
			SMITH
			all brazed joints

Check chart on page F-5 for answers.

APPLIED EXERCISE

2. CUTTING TORCH COMPARISONS WITH COMPETITION

In the scrambled listing below circle the items that apply to Airco Hand Cutting Torches and place them under the column marked, AIRCO HAND CUTTING TORCHES. Place those items that apply to competitors under the column marked COMPETITION HAND CUTTING TORCHES.

Primarily brass or bronze head
Simplicity of design
Premix
Tip mix
Can be used with all fuel gases
No flashbacks
Stainless steel on special order

Optional external injector adapter
Stainless steel or brass head
Complex design
Internal assembly must be changed for certain gases and applications
Susceptible to flashbacks
Limited application

AIRCO HAND CUTTING TORCHES	COMPETITION HAND CUTTING TORCHES

Check your answers on next page

ANSWERS

AIRCO	COMPETITION
Simplicity of design	Primarily brass or bronze head
Tip mix	Premix
Can be used with all fuel gases	Stainless steel on special order
No flashbacks	Complex design
Optional external injector adapter	Internal assembly must be changed for certain gases and applications
Stainless steel or brass head	Susceptible to flashbacks
	Limited application

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION F
TORCHES

1. Air Fuel Torches

2. Torch Handles

3. Cutting Attachments and Cutting Torches
   a. Manual
   b. Machine
      (1) Two-Hose and Three-Hose

4. Comparisons with Competition

BACKGROUND
The oldest ancestor of the welding torch is the blow pipe used by workers in gold, silver and brass. The fuel was generally alcohol and the worker was blowing air through a curved pipe to increase the intensity of the fuel combustion.

An appreciable improvement came with the Bunsen burner (found most often, today, in chemical labs). In this device, part of the air necessary for combustion is injected or sucked into the gas stream. The mixed gas and air then flow to the mouth of the burner where they ignite. This premixing of air and gas results in a flame of higher temperature than can be obtained by burning a gas in still air.

INTRODUCTION
In this section of the program we review the Airco line of "Torch Handles" for soldering, brazing, welding, heating and cutting. We have tried to simplify this discussion by referring to "Torch Handles" and describing their construction, along with those of competitors. These "handles" become "torches" only after a tip-mixer assembly or mixer and tip are selected and installed.

1. AIR FUEL TORCHES

Today the simplest torch used is the Air Fuel Torch. The torch consists of a fuel passage through a handle. One end of the handle has a valve with a thread to connect a hose. The other end has an internal thread and seat to receive a selection of tips or nozzle. See Fig. F-1.

The mixing of the air with the fuel takes place at the base of the tip. Fuels other than acetylene are used such as MAPP Gas and propane. When switching to another fuel it is only necessary to change the tip.

Air fuel tips and other tips are covered in detail in SECTION G. TORCH TIPS AND APPLICATIONS.

FLAME CHARACTERISTICS

Flame roots on tip end.

Flame consists of single primary cone and long secondary cone.

BENEFITS

Performs most soft soldering applications well.
Long Flame.
Heat is concentrated at a single point.

Stock No.	Outlet	Inlet
818-0270	1/2-20 R.H.	A Size (LH)

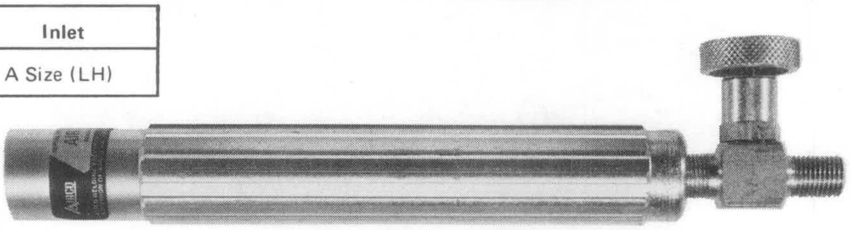


Figure F-1

2. TORCH HANDLES

Oxy-fuel welding and heating torches consist of a torch handle, a gas mixer, (or injector), and a welding or heating tip. A gas mixer and tip are often supplied as single units or as an assembly. Most oxy-fuel welding and heating torch handles have the same basic design. The method of assembling them differs. Airco welding torch handles consist of several parts: Two gas valves, one for fuel the other for oxygen; one rear-end forging; two gas tubes; and, a front-end part or head. These parts are connected together and a handle is slipped over the heading, tubes, and is secured to the rear-end forging on one end and the head on the other.

Torch handles do not mix gases, they only provide the final control and adjustment of the flame with the gas valves.

A recess or cavity, axially located in the torch head serves as a connecting seat for the tip mixer. The gases admitted through the valves, gas tubes and appropriate orifices in the torch head reach the mixer where they mix and flow through the tip. The difference in torch handle construction is in the means of sealing and attaching the parts.

The Airco torch (Fig. 2) is all silver-brazed except the outer handle which is mechanically fastened to the rear end forging and head. This mechanical fastening provides ease of repair. Some other torch handles are mechanically bonded and sealed by means of threads with sealing compound and metal to metal contact such as the Victor torch (Fig. F-3).

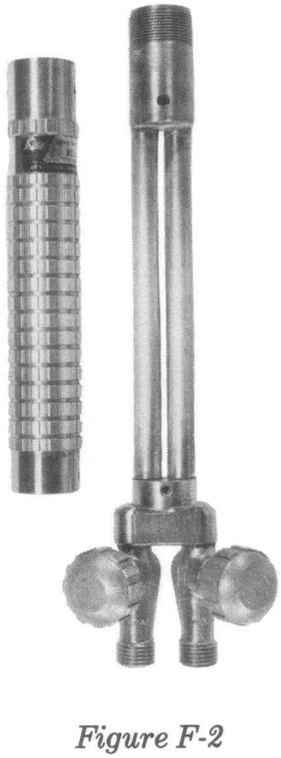


Figure F-2

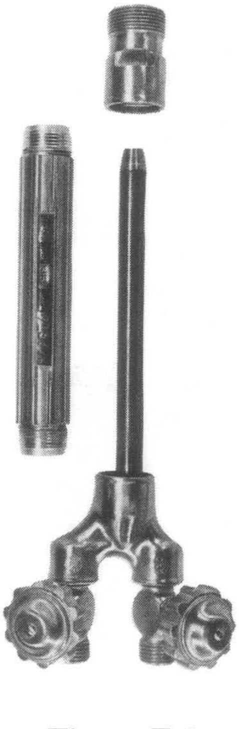


Figure F-3

The Harris torch is assembled with threads and rubber O-rings (Fig. 4). The outer tube or handle for both Victor and Harris serves as the fuel gas tube. The oxygen tube is axially located in the fuel tube. The end result is that the assembly is prone to leakage once the torch handle assembly is subjected to rough handling and wear and tear. Rubber O-rings deteriorate with heat and time. Their parts may distort and result in gas leaks. Metal-to-metal sealing by means of tapered fit, seals properly, provided that the mating surfaces are not disturbed and the proper pressure is applied. However, any slight distortion of the assembly will create leaks and once the torch has been taken apart for repair, the re-assembly of a tapered fit such as seen on Victor torches is very difficult.

The Smith torch handle is all silver brazed. However, there are two blind silver brazed joints within the handle which is also silver brazed to the rear end forging and head. These blind internal joints are difficult to leak test and therefore, a leaky unit can be sold unnoticed and an accident may occur.

The torch also accepts the mixer and tip. What makes a low pressure torch, is the low pressure injector which is installed on the torch handle to receive the tip. A positive pressure torch consists of the same torch handle with a positive pressure mixer. These mixers are reviewed in the SECTION G. TORCH TIPS AND APPLICATIONS.

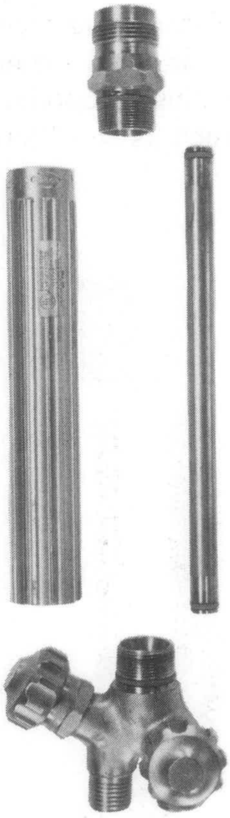


Figure F-4

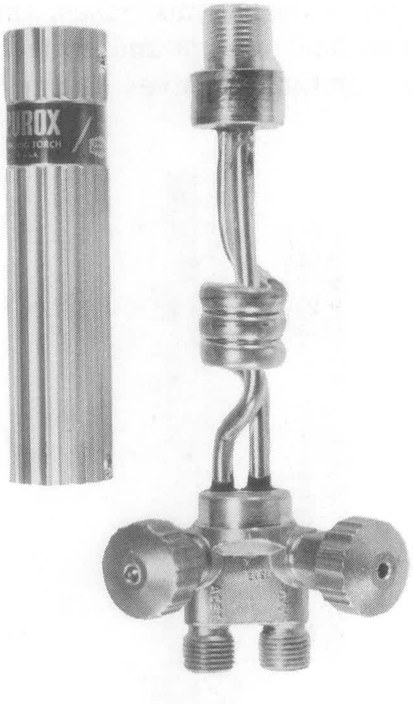
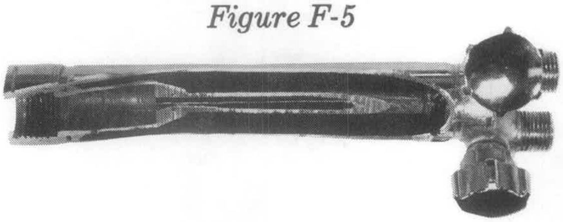


Figure F-5



3. CUTTING ATTACHMENTS AND CUTTING TORCHES

Beside accepting welding or heating tips, a welding torch handle may also be fitted with a cutting attachment which makes a cutting torch of the assembly. Attachments are widely used in the service, repair and maintenance trades.

The oxy-fuel cutting attachment pictured below fastens to the welding torch, replacing the welding tip, mixer and tip nut. The cutting attachment has two controls. The preheat oxygen valve on the side controls the flow of oxygen used in the preheat flame. The cutting oxygen lever on the top controls the flow of oxygen used in cutting.

A cutting tip connects to the attachment head. The fuel gas and oxygen that are combined to produce the preheat flame are mixed in the seat of the cutting tip.

In the steel fabrication industry, where oxy-fuel steel cutting is performed daily by the same men, torches designed exclusively for cutting are preferred.

a. Manual

In appearance the hand cutting torch is similar to a welding torch. It consists principally of a handle, connecting tubes and a head. The handle is equipped with oxygen and fuel gas hose connections on the rear.

A fuel gas control valve controls the fuel supply. The preheat oxygen valve on the side of the handle controls oxygen flow to the preheating flames. A cutting oxygen lever controls the flow of cutting oxygen.

Cutting torches are available with heads set at various angles: 75°, 90°, and 180° (straight) being common to most manufacturers. The torches are available in various lengths.

In covering the subject of cutting equipment, no differentiation is made between cutting attachment and cutting torches.

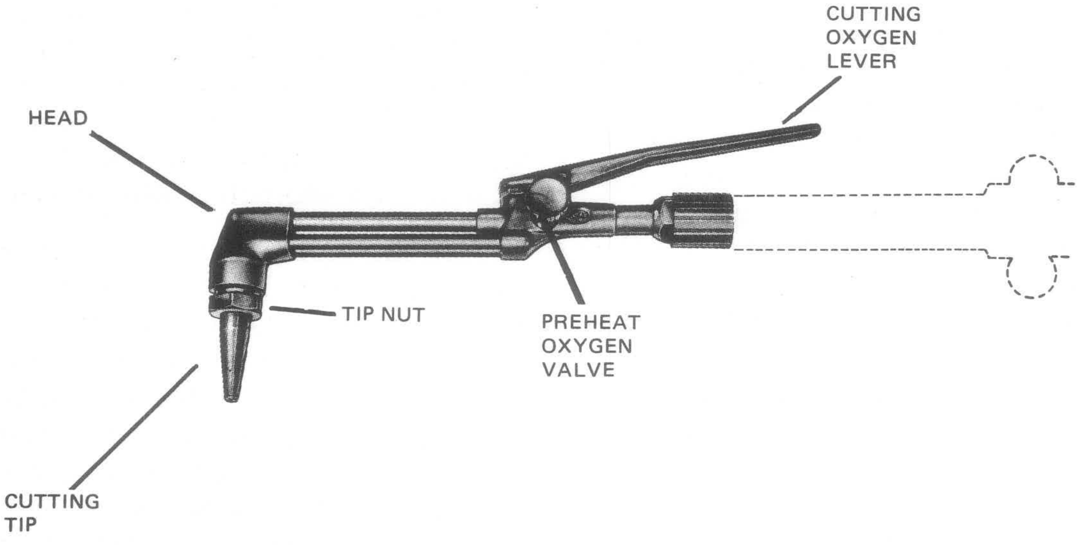


Figure F-6
CUTTING ATTACHMENT

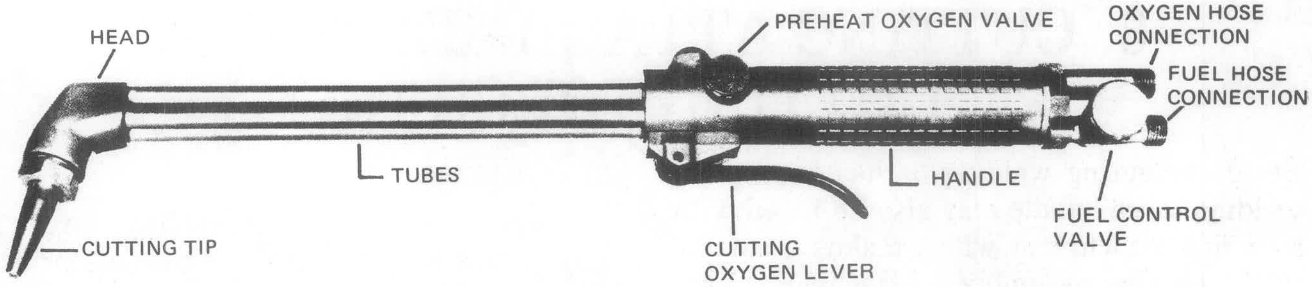


Figure F-7
CUTTING TORCH

CUTTING TORCH GAS MIXING SYSTEMS

There are two basic types of cutting torches. The injector or gas premixing torch and the medium or positive pressure torch.

INJECTOR OR GAS PREMIXING TORCHES:

Injector torches are often designed to work with low pressure fuel. They have limitations when high preheat gas flows are needed for heavy or scaly work, or any other operation requiring high preheat. They have the same limitation when used with medium pressure fuels. In this case the fuel regulator and torch valve adjustments reduce the excess fuel pressure. Injector torches designed for medium fuel pressure operation usually cannot be converted to low pressure fuel operation because the injector portion and throat section are independent of each other.

Unlike a welding torch handle which can be promptly fitted with either positive pressure mixer or an injector mixer; gas premixing cutting torches modifications are more involved and often not possible. Injector or gas premixing torches come in four main categories — (1) Low pressure natural gas, (2) low pressure acetylene, (3) medium pressure acetylene, (4) medium pressure fuels other than acetylene. In all injector torches the injector can be changed, however, the throat and diffuser elements are fixed. Modification means machining after which the torch cannot be restored to its original state. Other torches designed for medium pressure fuels other than acetylene cannot be modified for any other conditions. Acetylene injector or acetylene premixing torches have a serious limitation in preheat flow range. Preheat flow range is often referred as "turn up and turn down". Injector torches are also sensitive to burn back. A sustained burn back can be severe enough to damage the injector system which means a costly repair or it can destroy the torch.

The advantage of injector low pressure torches is that the fuel consumed by the torch remains fairly well in ratio as the preheat oxygen flow is raised or lowered which is a reason why multi-torch cutting machines usually are equipped with low pressure injector torches for ease of preheat control. The following explains the functioning of injector systems.

An injector type system operates as follows. The first element in the injector system is the preheat oxygen orifice (Fig. F-8) which is sized to obtain the desired flowrate vs. pressure curve. It is important that exit stream from this orifice be a high velocity stream; therefore, it should be designed to give the desired flow at an inlet pressure in the range of 10 to 60 p.s.i. If the inlet pressure drops much below 10 p.s.i., the velocity drops and little or no injector effect is produced.

The second element in the injector is the region in which the jet stream of preheat oxygen entrains the fuel and drives it downstream through the throat or inlet orifice of the diffuser. The removal of fuel from this region by the oxygen jet streams causes a reduction in pressure of 4-5 p.s.i. below atmospheric in the above mentioned region, which causes the system to "suck" fuel at the torch inlet.

The third element in the system is the

diffuser. It has an inlet orifice or throat sized exactly to match the high velocity stream of preheat oxygen mixed with fuel.

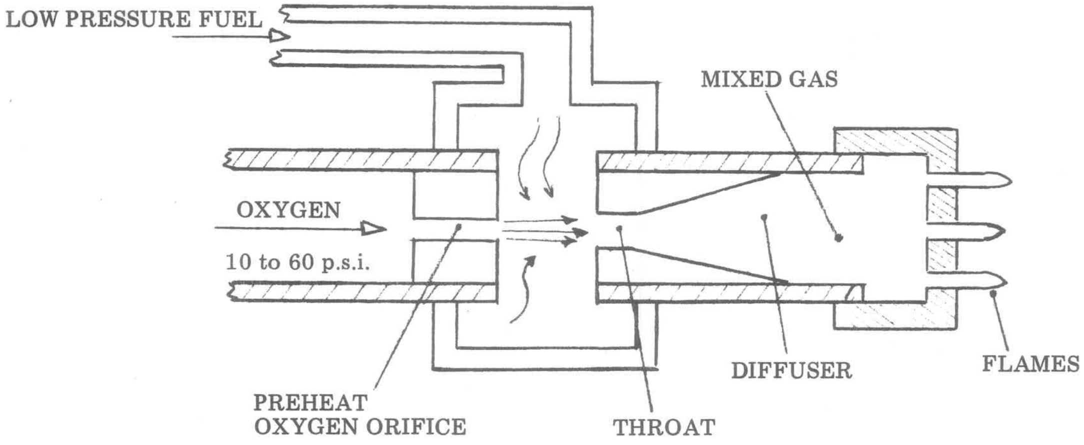


Figure F-8
INJECTOR SYSTEM

If it is either too large or too small or out of alignment, the injector action will be diminished or destroyed. The diffuser has an exit of gradually increasing diameter, which is essential as a pressure recovery section, where the high velocity low pressure stream is changed to a low velocity higher pressure stream, sufficient to force the gas mixture through the tip end. In using injector systems, the downstream gas ports at the tip must be large enough to allow the oxy-fuel-mixture to flow out freely. If it creates too much back pressure, the injector system will be choked, and the injector action destroyed.

POSITIVE PRESSURE CUTTING TORCHES — TIP MIXING

Tip mixing torches have many advantages. Although Airco has one or two injector or gas premixing torches in its line, nearly all of the Airco cutting torches sold are of the tip mixing type. This gives Airco a tremendous advantage over competitors who sell torch mixing systems. The simplicity of the torch design and its outstanding overall performance is well established. The safety inherent to the design eliminates completely any problems of "burning up" the torch. As the term "tip mixing" implies — the gases mix in the tip. The torch only serves to bring unmixed gases to the tip. The gases mix in the tip seat block and burn on the end of the tip. Any retrogression of the flame or burn back is confined to the tip. In most severe cases of flashback, the tip can be destroyed but not the cutting torch. Damage to an Airco cutting torch due to a retrogression of the preheat flame beyond the seat of the cutting tips is not possible. An Airco cutting torch is immune to flashback damage, while competitive torches are much more susceptible to flashback.

The other advantage of the tip mixing type torch is that it has great versatility. Airco tip mixing cutting torches need a minimum of 3 p.s.i. of fuel pressure at torch entry to operate and any fuel can be used.

The statement that 3 p.s.i. of fuel pressure is necessary to operate Airco tip mixing torches applies when they are used with Airco hard seat tips. A break-through occurred with the latest addition to the Airco tip line.

"The Aircomaster Cutting Tips". With these new tips the traditional three land tip seat block where the gas mixing takes place is separated from the front end of the tip. The result is that we have the choice of using a positive pressure gas mixing seat block or a new design low pressure injector seat block. This last injector has the unique advantage of behaving like a positive pressure seat block in case of burn back. It protects the torch from damage. When installed on any Airco positive cutting torches or cutting attachment, the injector converts them into a low pressure torch which will out perform any other natural gas or LPG gas torch in the business.

In Conclusion—

Airco cutting torches are strongly built. Most have distortion free stainless steel heads. They are free from burn back damage. They are safe. They are used with any fuels without need for modification, just change the tip.

When needed they can be quickly converted to low pressure torches. They are free from the inconvenience common to most competitive cutting torches which have internally located injector, diffusion chamber or gas mixing elements and spiral strips. All these elements can become subjected to a sustained burn back rooting itself within the competitive torch at a point of gas turbulence, where the intense heat of the flame can melt the part, whether it is a brass forged diffuser or a stainless steel mixing tube, thus destroying the torch and exposing the operator to substantial risk of injury.

(1) Two and Three Hose

MACHINE CUTTING TORCH

A machine cutting torch, although appearing physically very different from a hand cutting torch, is internally very much alike.

There are two basic types of machine cutting torches, the two-hose torch for single torch machine operation; the three hose torch for multi-torch operation.

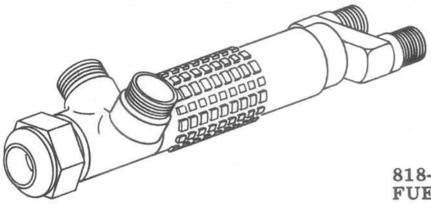
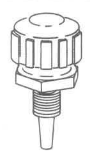
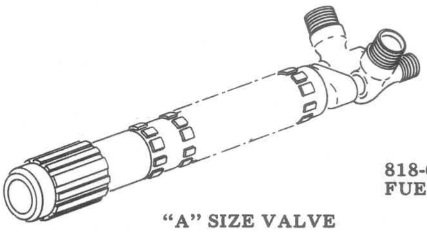
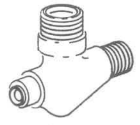
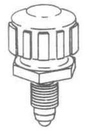
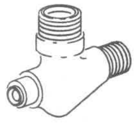
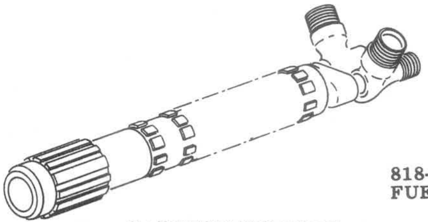
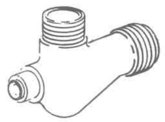
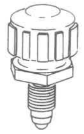
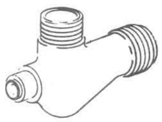
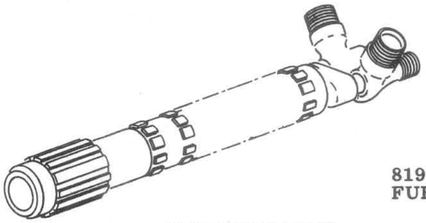
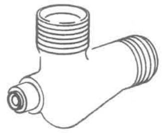
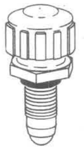
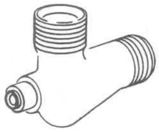
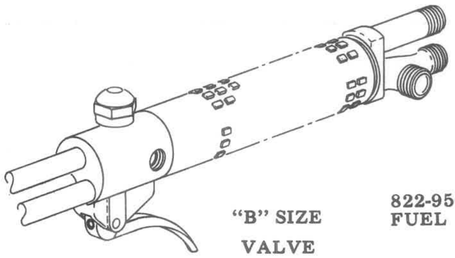
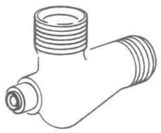
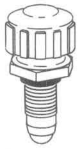
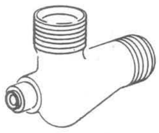
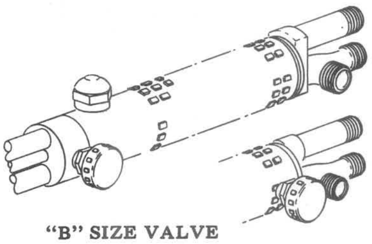
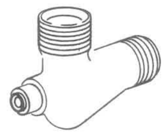
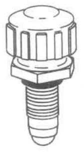
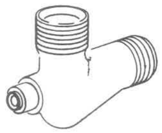
In two-hose operation, the cutting oxygen is supplied by the same hose that supplies the preheat oxygen. The operator manually opens the cutting oxygen valve.

In multi-torch operation, the cutting oxygen has to be turned on simultaneously via remote control. As a result, the cutting oxygen supply must be independent from the preheat oxygen supply.

4. COMPARISONS WITH COMPETITION

Comparisons have already been made in the chart on page F-5. Additional information appears in SECTION H: Welding and Cutting Outfits.

AIRCO TORCH VALVE CHART

TORCH	VALVE BODY	PRESENT STEM- 1971	VALVE BODY
 818-0400 FUEL OXY "A" SIZE VALVE	PART OF TORCH HANDLE	 831-2802 S.S. TAPERED	PART OF TORCH HANDLE
 818-0700 FUEL OXY "A" SIZE VALVE	 L. H. FUEL GAS 831-2604 R. H. OXYGEN 831-2608	 831-2798 S.S. BALL	 L. H. FUEL GAS 831-2604 R. H. OXYGEN 831-2608
 818-0750 FUEL OXY "A" STEM "B" BODY	 L. H. FUEL GAS 831-2605 R. H. OXYGEN 831-2609	 831-2798 S.S. BALL	 L. H. FUEL GAS 831-2605 R. H. OXYGEN 831-2609
 819-0800 FUEL OXY "B" SIZE VALVE	 L. H. FUEL GAS 831-2590 R. H. OXYGEN 831-2589	 831-2799 S.S. BALL	 L. H. FUEL GAS 831-2590 R. H. OXYGEN 831-2589
 "B" SIZE VALVE 822-9500 FUEL	 L. H. FUEL GAS 831-2590	 831-2799 S.S. BALL	 L. H. FUEL GAS 831-2590
 822-9000 FUEL 822-3000 FUEL "B" SIZE VALVE	 L. H. FUEL GAS 831-2590	 831-2799 S.S. BALL	 L. H. FUEL GAS 831-2590

AIRCO TORCH VALVE CHART [Continued]

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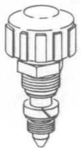
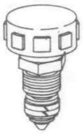
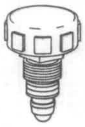
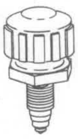
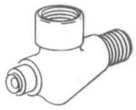
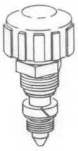
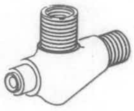
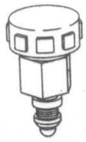
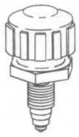
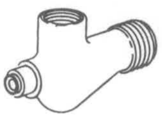
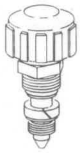
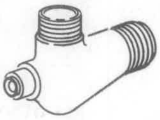
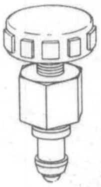
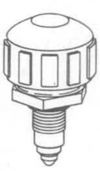
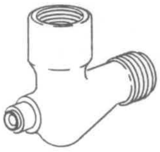
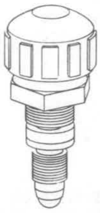
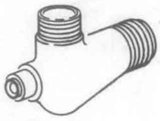
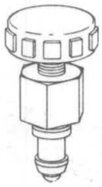
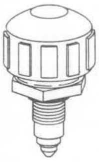
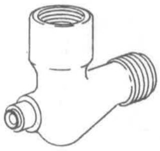
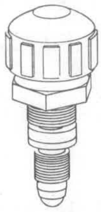
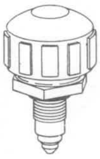
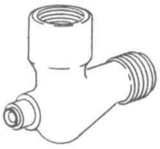
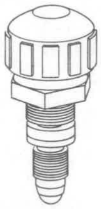
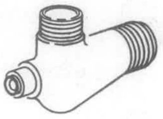
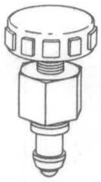
 831-2253 S.S. TAPERED	PART OF TORCH HANDLE	 831-2107 S.S. TAPERED	PART OF TORCH HANDLE	 831-1779 S.S. BALL
 831-2607 NYLATRON TAPERED	 L. H. FUEL GAS 831-2463 R. H. OXYGEN 831-2464	 831-2253 S.S. TAPERED	 L. H. FUEL GAS 831-0342 R. H. OXYGEN 831-0343	 831-9949 S.S. BALL
 831-2607 NYLATRON TAPERED	 L. H. FUEL GAS 831-2452 R. H. OXYGEN 831-2451	 831-2253 S.S. TAPERED	 L. H. FUEL GAS 831-1207 R. H. OXYGEN 831-1206	 831-9839 S.S. BALL
 831-2588 NYLATRON TAPERED	 L. H. FUEL GAS 831-2242 R. H. OXYGEN 831-2243	 831-2124 S.S. BALL	 L. H. FUEL GAS 831-1207 R. H. OXYGEN 831-1206	 831-9839 S.S. BALL
 83102588 NYLATRON TAPERED	 L. H. FUEL GAS 831-2242	 831-2124 S.S. BALL		
 831-2588 NYLATRON TAPERED	 L. H. FUEL GAS 831-2242	 831-2124 S.S. BALL	 L. H. FUEL GAS 831-1207	 831-9839 S.S. BALL

LESSON PLAN

SUBJECT: SECTION G: TORCH TIPS AND APPLICATIONS

OBJECTIVE: To instruct the participant on the Airco oxy-fuel tips used for welding, heating and cutting applications.

REFERENCE: Product Information Class 8 Text.
Section G: Torch Tips and Applications

TRAINING MATERIALS: Product Information Class 8 Text
Section G: Torch Tips and Application
Supplementary Material:
ADC 1148, Universal Heating Tips
AD Reprints: How To Buy a Better Heating Tip
How To Buy a Better Cutting Tip

PRESENTATION:

SEE ILLUSTRATIONS IN SECTION G: TORCH TIPS AND APPLICATIONS, TEXT MATERIAL

A. Air Fuel Tips — consists of a base and a bent tube
   1. Conventional type
      a. Base—secures the tip assembly to the torch; air and fuel mixing takes place.
   2. High Velocity Gas-Air Tips (RAM-JET)
      a. A flame holder is secured within the tip tube near the gas exit, which creates a gas rotation (which twists the gas stream); therefore, high heat transfer is possible which is higher than the heat created by a conventional tip.
   3. Pencil-point Flame Tip
      a. For MAPP Gas and propane when doing delicate work.

B. Welding Tips and Mixers
   1. A torch accepts a welding tip and a mixer. What makes it a low pressure torch is the low pressure injector which is installed on the torch handle to receive the tip.
      a. Low pressure is arbitrarily defined as pressure at less than one p.s.i. The need for injectors was brought about by the fact that sufficient pressure was not available to operate positive pressure mixers although sufficient flow was available.
      b. Inherent disadvantage of low pressure injector type equipment, is the fact that the design is fixed and allows no adjustment for pressure variations.

2. Positive pressure torch uses a positive pressure mixer.
   a. Uses medium pressure of fuel arbitrarily defined as pressure above one p.s.i.
   b. Mixer for positive pressure is simpler in design. Assures thorough and complete mixing of the gases. One mixer can be used over a wide range of tip sizes.
      1. Three styles of tips are available:
         Separable tip with 3/8" O.D.
         Copper tube, sizes 00 to 10.
         Separate tip of 7/16" O.D. tube sizes 1 to 10
         A tip mixer assembly made of 3/8" O.D. sizes 00 to 10

SEE ADC 1148 UNIVERSAL HEATING TIPS, IN SUPPLEMENTARY MATERIALS

C. Heating Tips
1. Universal heating tip line
   a. Separable type, Style 759 includes five sizes 5, 7, 8, 9, 10. Style 757, separable type also, includes six sizes 12, 13, 14, 16, 17, and 18. Style 756 tip and tube assemblies consist of sizes 10, 12, 13 and 14. The three largest sizes 16, 17, 18 are not to be used with acetylene.
   b. The essential details of Universal heating tips are included in the brochure ADC 1148.
   c. In addition to the Universal line there are three other multi flame heating tips.
      1. Style 842, size 10, is a tip and mixer assembly for Style 800 torch.
      2. Style 742, size 10, is a tip and mixer assembly for Style 400 torch.
      3. Style 754, size 8, tip and tube assembly for the Style 400 torch

SEE AD REPRINT, HOW TO BUY A BETTER HEATING TIP, IN SUPPLEMENTARY MATERIALS

2. Review AD Reprint (Heating Tip) in Supplementary Materials.

D. Oxy-Fuel Cutting

1. The oxygen-fuel cutting process involves the combination of a chemical reaction and mechanical erosion of the molten metal.
   - a. The chemical reaction begins when preheat flames bring the steel to be cut to a kindling temperature (steel turns cherry red). A jet of oxygen is introduced and rapid oxidation takes place.
2. Preheat flames serve several functions
   - a. Bring steel to kindling temperature
   - b. Remove mill scale
   - c. Maintain small bright spot of molten metal ahead of cutting oxygen stream to insure a continuous cut.
   - d. Protect oxygen stream from surrounding air.
   - e. Maintain slag in a fluid condition to flow down the kerf.
3. Quality of cut
   - a. Quality decreases as speed is increased above certain speeds.
   - b. Quality is determined by end use of the part.
   - c. Prime cut is achieved with the proper cutting oxygen jet and speed.
     - 1. High quality cut exhibits smooth face of cut; cut is perpendicular with the plate; top edge is not rolled; the lower edge is free of slag.

E. Airco Cutting Tips

1. Categorized in two ways
   - a. By fuels and construction
   - b. By operation, general purpose or high speed.
2. Fuel and construction

REVIEW ONE PIECE TIP ON THE CUT-AWAY PHOTO OF THE CUTTING ATTACHMENT IN SUPPLEMENTARY MATERIALS

   - a. Solid copper tips, one piece, for acetylene and MAPP Gas.

SEE AD REPRINT ON HOW TO BUY A BETTER TIP IN SUPPLEMENTARY MATERIALS.

   - b. Two piece tips for MAPP Gas, natural gas and other liquid petroleum gases.

3. By operation
   a. General purpose—solid copper one piece, or two piece tips with a straight bore oxygen port. Average cutting oxygen pressure is 50 p.s.i. Used for hand operations and small cutting machines
   b. High speed—solid copper one piece tip or two piece tips with a divergent bore
      1. Has smaller oxygen orifice
      2. More pressure used, 100 p.s.i. permitting greater speeds.
      3. End of oxygen orifice is tapered.
      4. Cutting tips are designated in much the same way as welding tips: by a numerical range in which the smaller the number, the smaller the openings.
      5. There are tips for special applications: gouging, rivet washing, heavy heating jobs, etc.

F. Master Tips
   1. Introduced as cost savings and flexible—four styles.
      a. Two styles for general purpose
      b. Two styles for machine cutting.

ORAL TEST. ASK FOR VOLUNTEERS TO ANSWER QUESTIONS

TEST
SECTION G: TORCH TIPS AND APPLICATIONS

1. An air fuel tip consists of a __________ and a __________ tube.

2. The RAM-JET tip is a conventional tip. (True/False)

3. When doing delicate work, the ____________-____________ flame tip is used.

4. When a low pressure injector is installed on a welding torch handle, it becomes a ______ ________________ torch.

5. The need for injectors was necessary because sufficient pressure was not available to operate ________________ pressure mixers.

6. A ________________ pressure mixer uses a medium pressure of fuel arbitrarily defined as pressure above ________ p.s.i.

7. There are available three types of welding tips. Fill in the blank spaces.
    a. __________________ tip with 3/8" O.D. copper tube, sizes 00 to 10.
    b. __________________ tip of 7/16" O.D. tube sizes 1 to 10.
    c. A ______ __________ assembly made of 3/8" O.D. sizes 00 to 10.

8. The largest sizes of Universal heating tips are numbers ____, ____, ____ and are not to be used with __________________ fuel gas.

9. In oxy-fuel cutting the preheat flames serve several functions. Circle the one that does not apply.
    a. Protect oxygen from surrounding air.
    b. Remove mill scale
    c. Bring steel to kindling temperature
    d. Controls the rate of speed of the cut.

10. High speed cutting tips come in either ______ piece or ________ pieces with a __________________ bore.

11. Cutting tips are designated in much the same way as welding tips—by a numerical range in which the (smaller/larger) the number, the (smaller/larger) the openings.

12. Master tips are made in four styles—two styles for ______________ ____________, cutting and two styles for ______________ cutting.

ANSWERS
SECTION G: TORCH TIPS AND APPLICATIONS

1. Base, Bent
2. False
3. Pencil-point
4. Low pressure
5. Positive
6. Positive, One
7. Separable, Separable, Tip Mixer
8. 16, 17, 18, Acetylene
9. d. Controls the rate of speed of the cut.
10. One, Two, Divergent
11. Smaller, Smaller
12. General Purpose, Machine

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION G:
TORCH TIPS AND APPLICATIONS

1. Air Fuel Tips
    a. Theory of Brazing and Welding

2. Welding Tips and Mixers
    a. Injectors

3. Welding Tip Assemblies and Separable Tips

4. Heating Tips

5. Theory of Oxy-Fuel Cutting

6. Cutting Tips
    a. General Purpose (Straight Bore)
    b. Machine Cutting (Divergent)

7. Master Tips

8. Tip Maintenance

1. AIR FUEL TIPS

Air fuel tips generally consists of a base and a bent tube. The base serves to secure the tip assembly to the torch. It is also in that base that the air fuel mixing takes place (Fig. G-1). An orifice axially located in the tip base forces a jet of fuel through a "venturi", creating a suction of air into the tip through holes in the tip base.

This fuel and air mixture travels within the tip tube and when ignited, burns at the end of the tip.

The fuel passage and venturi are designed to permit the proper ratio of air to full to be obtained. Acetylene needs about nine parts of air to give an adequate flame. MAPP Gas and propane need about 16-18 parts of air.

CONVENTIONAL AIR ACETYLENE LINE

FLAME CHARACTERISTICS

Flame roots on tip end.

Flame consists of single primary cone and long secondary cone.

BENEFITS

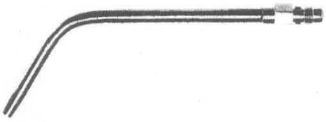
Performs most soft soldering applications well.
Long Flame.
Heat is concentrated at a single point.

Stock No.	Outlet	Inlet
818-0270	1/2-20 R.H.	A Size (LH)

GAS-AIR TORCH

TIP SELECTION

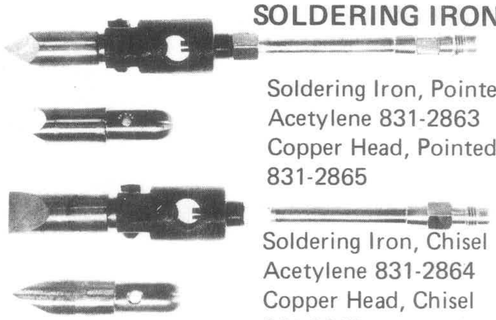
Acetylene Tip Guide



Conventional Tip			Copper Tubing (Work Sizes) Maximum Diameter (inches)		
			Process		
Size	Stock No.	Flow Range (cfh)	Soft Sold'g	Silver Braz'g	Phos-Cu Braz'g
1	810-1011	1 to 4	3/8	1/4	none
3	810-1013	1 to 4.3	3/4	1/2	none
5	810-1015	3 to 9	1-1/2	3/4	none

Figure G-1

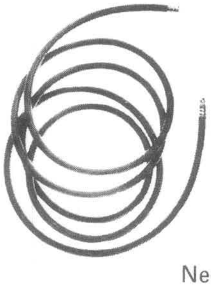
SOLDERING IRONS



Soldering Iron, Pointed
Acetylene 831-2863
Copper Head, Pointed
831-2865

Soldering Iron, Chisel
Acetylene 831-2864
Copper Head, Chisel
831-2866

HOSE

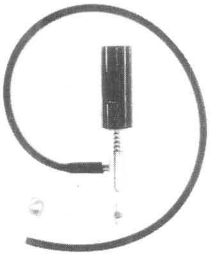


AIRCO "500" Special 10 feet with "A" L.H. fittings on both ends.

831-2846

Neoprene lining inside and outside — Recommended for use with all fuel gases.

HALIDE LEAK DETECTION EQUIPMENT

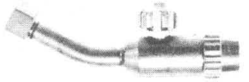


LEAK DETECTOR

Halide Leak Detector — Acetylene
831-2860

All copper Reactor Plate
831-2861

Two piece Reactor Plate
831-2862



Leak Detector
Adaptor w/shutoff
valve (45°)

Leak Detector Adaptor (For MC Tanks) 839-0205

Figure G-1 Con't.

The earlier air fuel tips (referred to as conventional tips) produce a flame which burns off the end of the flame tube. That flame can easily be extinguished by air drafts. Conventional air acetylene flame is widely used in heating and refrigeration. Conventional MAPP Gas and propane tips are also used, but are much inferior to acetylene.

The newest generation of air-fuel tips referred to as "high-velocity tips" has greatly increased the efficiency of air-fuel application and has brought increased use of MAPP Gas and propane fuel.

HIGH VELOCITY GAS-AIR TIPS (Fig. G-2)
The newest tips differ from the conventional tips only in their flame ends. An element, which we call a flame holder is secured within the tip tube near the gas exit. The purpose of the flame holder is to create a gas turbulence. Once ignited the flame roots itself inside the tube on the flame holder and the burning gas accelerates within the tip end. The portion of tube between the source of turbulence and the tip end becomes an expansion chamber which accelerates the combustion products and greatly increases the burning rate in the combustion zone. The effect is not that the flame has a higher temperature than a conventional air-fuel flame, but it is highly turbulent and operates at twice the flowrate in a given size barrel. The end result is that the flame has a substantially higher heat transfer than a conventional tip, particularly when compared to conventional MAPP Gas and propane tips. Since the turbulence is in most cases created by a spiral flame a holder rotating effect or twist is given to the flame.

Airco's competition uses names such as Turbotorch — Prestolite Swirljet — Uniweld Twister, etc.

Unlike competition, Airco Ram Jet tips for MAPP Gas and propane have a two-stage injector which insure a better air to fuel ratio giving complete combustion of the fuel. It also permits one to vary the pressure from 7 or 8 p.s.i., without overheating the tip end to as high as 40 p.s.i. giving a large flow variation in a given tip. Because of this, fewer tips are required to cover a broad range of use. Since acetylene can be safely used only to 15 p.s.i., four tips are required to cover, adequately a practical work range. Acetylene Ram Jet tips should be used at about 12 p.s.i.

Most competitive MAPP Gas and propane high velocity gas air tips are required to operate at higher pressure to avoid overheating; as a result they cannot be adjusted for various flows.

RAM JET™
HIGH VELOCITY GAS-AIR TIPS ACETYLENE-PROPANE-MAPP® GAS SOLDERING AND BRAZING

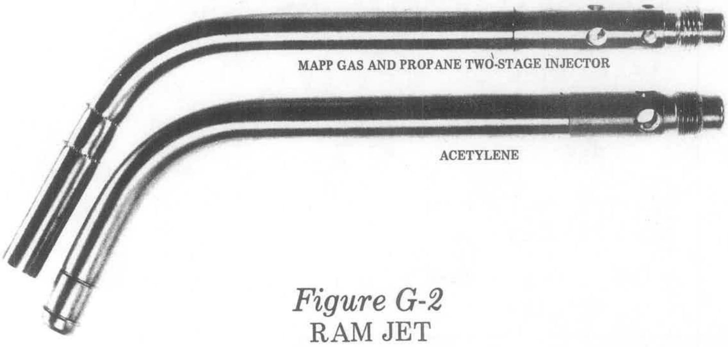


Figure G-2
RAM JET

SUMMARY

RAM-JET high velocity tips perform high temperature phos-copper brazing using very portable gas-air equipment. Air conditioning servicemen, plumbers, and maintenance men will find that RAM-JET tips will reduce brazing time substantially over conventional gas-air tips.

CUSTOMER BENEFITS

- Easy to light and use.
- Tips stay lit in drafts because flame anchors inside tip.
- Tips fit Airco and most competitive torches with standard 1/2-20 tip seats.
- Tips are relatively quiet.
- Soft solder, silver brazing and phos-copper within work range.
- Two-stage injector on MAPP® Gas and propane tips insures proper mixture of fuel and air over a pressure range of 10-40 p.s.i.
- Stainless steel tubes and silver brazed assembly for extended tip life.

APPLICATIONS

Soft solder, silver brazing and phos-copper brazing of copper tubing are amoung the uses for RAM-JET Tips. Besides professional applications, RAM-JET tips are used for industrial or home maintenance. They can also be used for hobby brazing, heating and automotive maintenance.

RAM-JET MAPP Gas and propane tips utilize a uniquely designed two-stage injector which guarantees accurate air-fuel mixing over the pressure range of 10 to 40 p.s.i.g. Because of this capability, only two tips are required to cover a broad range of uses. Since acetylene can be safely used only to 15 p.s.i., four tips are required to adequately cover a practical work range. Acetylene RAM-JET tips should be used at about 12 p.s.i.

PENCIL-POINT FLAME TIPS

Gas and propane gives off a flame which has a well defined and sharply pointed flame cone for delicate work such as used in making jewelry or other commercial/hobby applications.

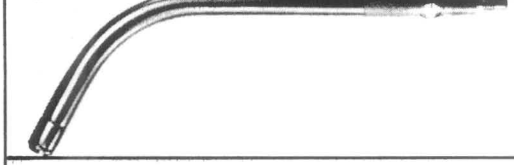
The advent of the high velocity gas air tip led to another development — the pencil point flame tip. The pencil point flame for MAPP

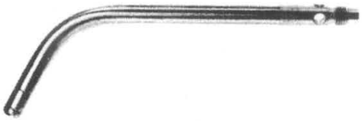
The following pages illustrate the Airco line of equipment for air-fuel use.

HIGH VELOCITY GAS-AIR BRAZING TIPS
ACETYLENE-PROPANE-MAPP® GAS

FLAME CHARACTERISTICS	BENEFITS
Flame roots inside tip end. Flame consists of multiple primary cones and a bushy secondary cone. Flame is directionally confined inside of tip and exits from tip end at high velocity.	Flame stability — under windy conditions. Tips can be used over a wide pressure range. Flame wraps around tubing and is not deflected. Improved heat convection to workpiece. Phos copper within work range.

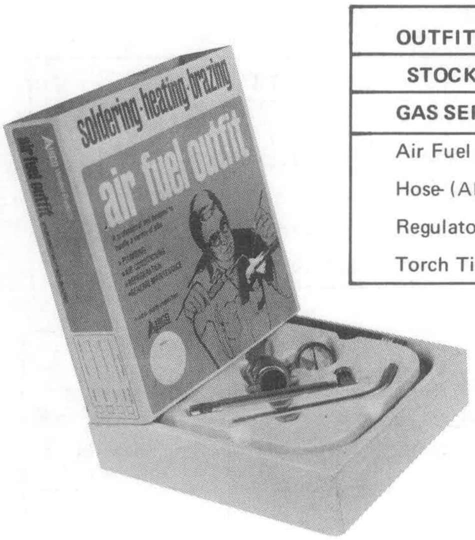
TIP SELECTION

	RAM JET Tip (High Velocity)			Copper Tubing (Work Sizes) Maximum Diameter (inches)		
				Process		
Acetylene Tip Guide	Size	Stock No.	Flow at 13 psig (cfh)	Soft Sold'g	Silver Braz'g	Phos-Cu Braz'g
	3	810-1003	2.3	3/4	3/8	1/4
	5	810-1005	6	1-1/2	3/4	3/4
	10	810-1010	10	2	1-1/2	1-1/2
	25	810-1025	29	6	2-1/2	2-1/2

MAPP Gas And Propane Tip Guide	Size	Stock No.	Gas	Flow 14 psig (cfh)	Soft Sold'g	Silver & Phos-Copper Brazing
	1	810-1031	MAPP	.66	Wire	Wire
	3	810-1033	MAPP Propane	1.5	1"	1/2"
	4	810-1034 810-1044	MAPP Propane	3	to 1-1/2	to 3/4
	5	810-1035 810-1045	MAPP Propane	11	1 to 6	3/4 to 2-1/2

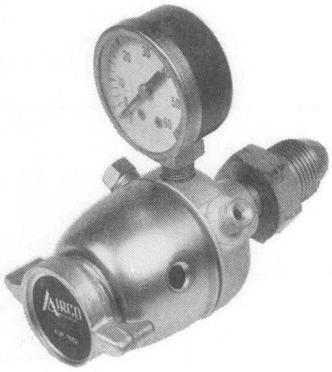
Pencil Point Flame Tips					
	00	810-1029	MAPP	.35	Light Wire
	0	810-1030	MAPP	.66	Soft solder and Silver brazing
	2	810-1032	MAPP Propane	2.8	All Lead Work

AIR-FUEL OUTFITS



OUTFIT TYPE	CONVENTIONAL	HIGH VELOCITY RAM JET		
STOCK NO.	840-0092	840-0093	840-0094	840-0095
GAS SERVICE	ACETYLENE	ACETYLENE	MAPP GAS	PROPANE
Air Fuel Torch	818-0270	818-0270	818-0270	818-0270
Hose-(AIRCO "500")	831-2846	831-2846	831-2846	831-2846
Regulator	806-7052	806-7052	806-7072	806-7072
Torch Tip	810-1013	810-1005	810-1034	810-1044

REGULATORS



ADJUSTABLE REGULATORS – SERVICE CYLINDERS

DESCRIPTION	GAUGES	STOCK NO.	OUTLET	INLET
Regulator:				
Acetylene	Contents	806-7052	A size (LH)	B Cylinder (RH)
Acetylene	Contents	806-7062	A size (LH)	MC Cylinder (RH)
L.P. Gas	Delivery	806-7072	A size (LH)	POL Cylinder (LH)

ONE-POUND DISPOSABLE CYLINDERS

These diaphragm-type regulators fit one one-pound disposable MAPP Gas and propane cylinders. They have a delivery pressure range up to 35 p.s.i.

When mounted on a disposable cylinder they permit work with the cylinder in any position without affecting the flame adjustment.

DESCRIPTION	STOCK NO.	OUTLET
MAPP Gas or Propane Regulators	806-7014	A size (LH) For Hose and Torch
	806-7019	1/2-20 Int. thread – Tip fits into Regulator

THEORY OF BRAZING AND WELDING

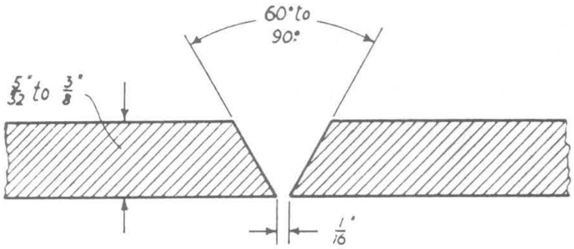
BRAZE WELDING PROCESS:

DEFINITION: Braze welding is a method of welding whereby a groove, fillet, plug or slot weld is made using a non-ferrous filler metal, having a melting point below that of the base metals but above 800°F. The filler metal is not distributed in the joint by capillary attraction. (Bronze welding, formerly used, as a misnomer for this term.)

Braze welding when used to join the high melting point metals, such as cast iron, malleable iron and steel, uses such non-ferrous metals as bronzes and brasses, which melt at considerably lower temperatures. In braze welding with brass rods the base metal is never heated to the melting point, but only to approximately a cherry red. The bronze or brass filler metal is melted, however, and flowed over the base metal.

Braze welding is based on the principle that, when a suitable ferrous metal is heated to sufficient temperature and its surface is then thoroughly cleaned by chemicals in the form of flux, certain copper alloys will join so closely with the molecules of the base metal that a very strong union or bond results. The molten copper alloy covers the base metal in a thin film, in the same manner that water will spread over a clean glass plate. The bond thus produced depends on the action of molecular forces at the copper alloy-base metal interface. The copper alloy generally forms a thin layer, practically the equivalent to plating the base metal. This action is called "tinning."

In addition, a diffusion of the copper alloy constituents, copper, zinc, tin and others, into the base metal, and a corresponding diffusion of base metal constituents into the copper alloy takes place in an narrow zone at the copper alloy-base metal interface. This interalloying is apparent when the juncture is examined under the microscope. This accounts for the very great strength of the copper alloy-base metal bond.



WELDING TIP SIZE vs MATERIAL THICKNESS

TIP SIZES	#00	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
ACETYLENE	1/64	1/32	1/16	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4 & Up
MAPP GAS		1/64	1/32	1/16	3/32	1/8	3/16	1/4				

BRAZING:

DEFINITION:Brazing is a group of welding processes wherein coalescence is produced by heating to suitable temperatures above 800°F. and by using a non-ferrous filler metal having a melting point below that of the base metals. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction.

From this definition it can be seen that the difference between braze welding and brazing lies in the limitation that in brazing the filler metal is distributed by means of capillary attraction.

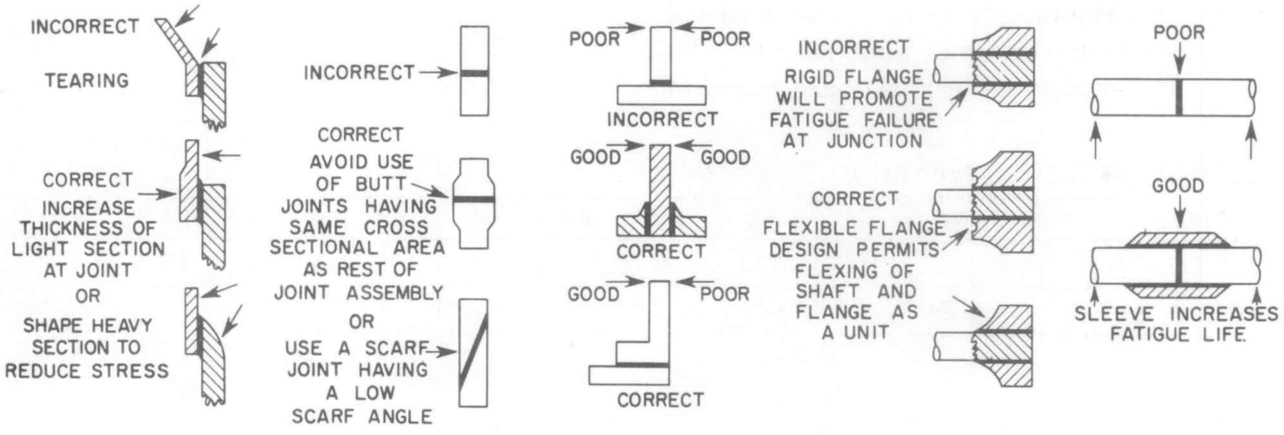
The difference between brazing and soldering operations where the filler metal is distributed by capillary attraction is the temperature at which the filler metal is melted. When it is below 800°F. it is soldering; above 800°F. it is brazing.

There are many different methods of brazing, such as torch brazing, furnace brazing, induction brazing and resistance brazing. Various brazing joints are shown in (Fig. G-3). In this program we will only deal with oxy-acetylene and oxy-fuel gas torch brazing.

TYPES OF BRAZING:The most common torch brazing operations fall into three classes: aluminum brazing, silver alloy brazing, and copper alloy brazing. These classes of brazing cover a wide range of temperatures from the low melting temperatures used when brazing aluminum, to the high temperatures used when brazing steel with copper alloys. (See Fig. G-4) for an overall picture of the temperature ranges involved in brazing.

Aluminum brazing is the brazing of pure aluminum or aluminum alloys using aluminum brazing alloys and the appropriate fluxes. This is done in the temperature range from about 815° to 1220°F.

Silver alloy brazing is used for brazing copper, brass, bronze, and all the ferrous metals. It entails the use of an alloy of silver, copper and/or zinc, with other alloying elements such as cadmium, nickel, phosphorus, tin etc., sometimes added. A suitable flux is generally used to clean the surface and prevent oxidation.


INCORRECT
TEARING
CORRECT
INCREASE THICKNESS OF LIGHT SECTION AT JOINT
OR
SHAPE HEAVY SECTION TO REDUCE STRESS
INCORRECT
CORRECT
AVOID USE OF BUTT JOINTS HAVING SAME CROSS SECTIONAL AREA AS REST OF JOINT ASSEMBLY
OR
USE A SCARF JOINT HAVING A LOW SCARF ANGLE
POOR
POOR
INCORRECT
GOOD
GOOD
CORRECT
GOOD
POOR
CORRECT
INCORRECT
RIGID FLANGE WILL PROMOTE FATIGUE FAILURE AT JUNCTION
CORRECT
FLEXIBLE FLANGE DESIGN PERMITS FLEXING OF SHAFT AND FLANGE AS A UNIT
POOR
GOOD
SLEEVE INCREASES FATIGUE LIFE

PREVENTING TEARING OF LAP JOINTS

MEANS OF IMPROVING IMPACT STRENGTH OF BRAZED JOINTS

BRAZED JOINTS FOR RESISTANCE TO IMPACT AND

BRAZED JOINTS FOR SHAFTS AND FLANGES

BRAZED JOINTS FOR ROTATING BEAM ACTION

Figure G-3
JOINT DESIGNS FOR BRAZING

Copper and copper alloy brazing is the brazing of ferrous and non-ferrous metals using copper and copper base alloys with or without a flux. Some of these materials can be used for brazing copper, brass or bronze only, while others can be used on metals such as on brass, bronze, copper, steel, nickel, and cast iron. The brazing temperature range and the chemical composition will generally determine the use to which a particular copper brazing alloy can be put.

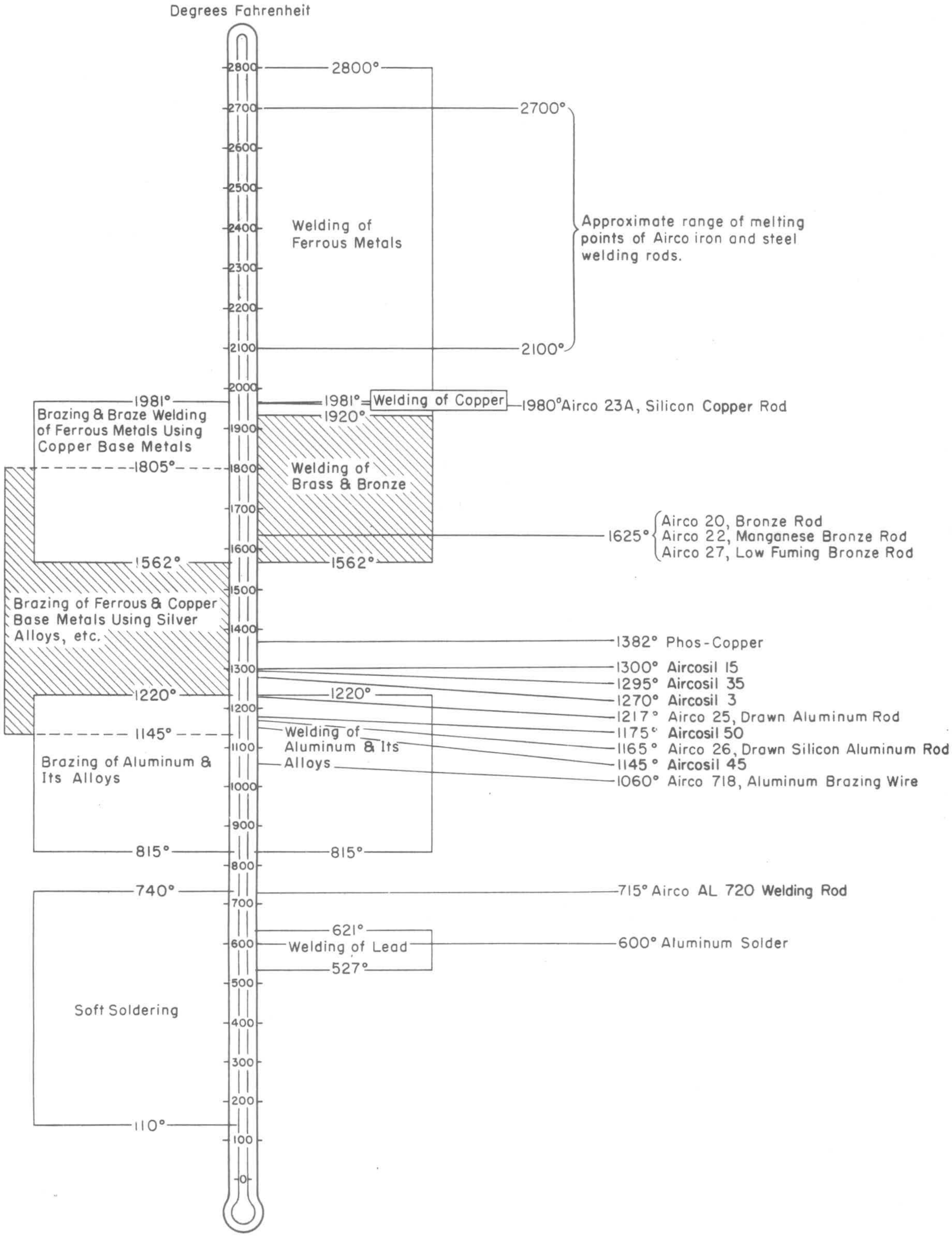


Figure G-4

CHART OF WELDING PROCESSES AND FILLER RODS AS RELATED TO TEMPERATURE

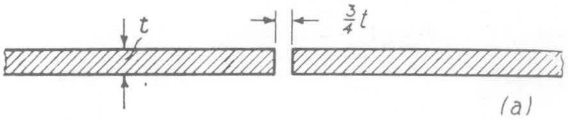
OXYACETYLENE WELDING

DEFINITION: Oxyacetylene welding is a gas welding process wherein coalescence is produced by heating with flames obtained from the combustion of acetylene with oxygen, with or without the application of pressure and with or without the use of filler metal.

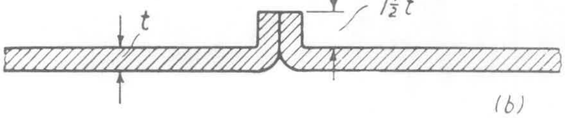
GENERAL PRINCIPLES: In oxyacetylene welding the edges to be welded are first properly prepared. Then they are correctly spaced and aligned for welding. Next the edges are melted down with the oxyacetylene flame produced at the tip of the welding torch. In this operation, various torch movements or manipulations are employed. The molten metal flows until each edge is completely fused or consolidated with the other. Filler materials or welding rods may or may not be used to assist in completing the weld.

For certain metals, flux is required to remove the oxides and protect the molten metal from contact with the air. After the metal has cooled there is a single continuous piece, with no joint or seam. Ordinarily, the weld is made progressively along the seam.

Fusion and penetration through the entire thickness of the metal are, of course, essential. Where the metal is too thick for complete penetration with a square butt joint, the edges are beveled. The vee formed by placing two beveled edges together provides sufficient space at the top to allow the tip to be held close enough for the flame to thoroughly fuse the bottom edges of the vee. Welding rods are used to fill up the vee. Proper manipulation of both the welding flame and welding rod is essential in order to assure good results. Correct flame adjustment, to suit the material being welded, is also essential.



(a)



(b)

WELDING TIP SIZE vs MATERIAL THICKNESS

TIP SIZES	#00	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
ACETYLENE	1/64	1/32	1/16	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4 & Up
MAPP GAS		1/64	1/32	1/16	3/32	1/8	3/16	1/4				

2. WELDING TIPS AND MIXERS

LOW AND MEDIUM FUEL PRESSURE SYSTEMS:

An Airco torch may be used with low or high fuel gas pressure, depending upon the type of gas mixing device used. A torch for use with low pressure fuel gas uses an "injector" mixing device; a mixer is used with medium pressure fuel gas systems.

Low pressure is fuel pressure arbitrarily defined as being less than one p.s.i. Medium pressure is defined as fuel pressure ranging from 1 to 15 p.s.i. with acetylene or more with other fuels. Fifteen p.s.i. is the upper safe limit for use of acetylene in the U.S.A.

Airco welding torches use medium pressure mixers for acetylene welding. However, low pressure injectors are available for low pressure natural gas. Low pressure is also used with liquid petroleum fuels when special safety conditions are required and, sometimes, in extreme cold weather.

Operation of Low Pressure Injector Mixer (Fig. G-5.)

The low pressure injector is designed to operate with only a few ounces of fuel pressure. The fuel gas tube is generally larger so that greater gas flows can be obtained at the low fuel pressure. In contrast to the low fuel pressure injector systems the oxygen enters the torch at comparatively high pressure. It passes through a nozzle in the injector mixer which transforms the high pressure into high velocity. In so doing, the oxygen stream produces a suction which draws in the low pressure acetylene through side openings from the fuel chamber in the mixer. In this way, the injector mixer serves to aspirate or draw in sufficient fuel to produce various theoretical oxygen-fuel ratios. Having aspirated sufficient fuel the high velocity stream forces the combined gases into a divergent mixing chamber where the oxygen and fuel mix together in a turbulent stream meanwhile the velocity energy of the mixed gas stream transforms itself into pressure energy and flows through the tip.

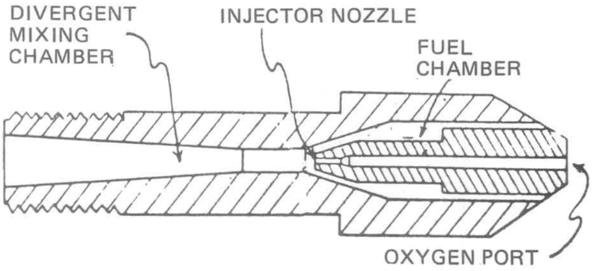


Figure G-5
INJECTOR MIXER

Low Pressure Flame — One of the inherent disadvantages of low pressure injector type equipment is the fact that the injectors are fixed, having no means of adjustment to allow for variations in acetylene pressure. The injectors are designed and adjusted in the factory for fixed oxygen and acetylene pressure. Variation of the oxygen pressure from the designed norm disturbs the balanced condition and tends to alter the proportions of oxygen and acetylene in the mixture. For perfect operation of the injector both the oxygen and acetylene pressures must be held invariable within very close limits and at the pressures for which it has been factory adjusted.

Any variation in pressures will destroy the balance necessary to achieve the precise gas ratio needed for a welding flame.

Operation of Medium Pressure Mixer (Fig. G-6)

The mixer used with medium pressure torches is simpler than the low pressure injector mixer just described. Both oxygen and fuel are brought to the torch at positive

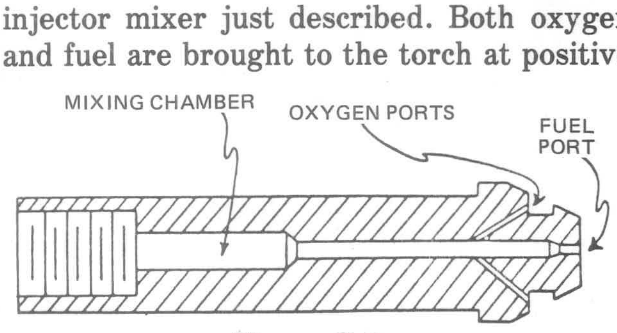


Figure G-6
MEDIUM PRESSURE MIXER

and ample pressures to overcome the pressure drop through the torch mixer and tip. The pressures of the two gases are approximately the same. Eash gas passes through the shut-off valves and the gas tubes in the head, just as in the case of low pressure welding torches. The difference here is that the gas tubes in the torch body may be the same size, since the fuel and oxygen are under approximately equal pressures.

At the front end of the torch oxygen and fuel enter the mixer, the oxygen being introduced through the central passage of the mixer. The fuel meets the oxygen through four smaller passages. The two gases are thoroughly mixed and flow smoothly from the tip.

Medium Pressure Flame — The design of the mixer and welding tip assures a thorough and complete mixing of the gases. The design also provides for control of the velocity of the gases, and reduces the turbulence of the gas stream so the gas emerges smoothly and evenly. The control of the velocity of the issuing gas stream reduces backfire tendencies, which will be treated in more detail later. It is possible, however, by adjusting the gas pressure to vary the flow through a given size welding tip over a considerable range. Therefore, flames of varying intensity can be obtained. One mixer can be used for a wide range of tip sizes.

With the medium pressure torch a very efficient flame is produced. The inner cone is sharply defined and symmetrical. The flame burns steadily, and since the gas mixture emerges from the tip at a constant velocity without turbulence, it is free from fringes or feathers on the edges of the inner cone. The outer envelope of the flame is soft and quiet, providing a shield which protects the weld puddle from atmospheric contamination.

The Correct Flame For The Job — Although there has been much controversy over low pressure vs. medium pressure acetylene welding, nowadays low pressure systems are seldom used. Acetylene is generally supplied in high pressure cylinders. Pressure is important because it has an effect on the shape or appearance of the flame. And flame shape greatly influences the ability to do a job at all, if not solely to do a job efficiently.

Therefore, one of the prime functions of an oxy-acetylene welding torch is to produce maintain a stable flame of the most efficient type for the work to be done.

The requisites to produce such an oxy-acetylene flame are:

An accurately metered and unvarying supply of each gas, to assure a constant mixture of the gases in exactly the correct proportions and a thorough and intimate mixing of the gases to produce a homogeneous gas mixture.

Sufficient positive pressure and velocity of the gases at the exit orifice of the tip to prevent backfire.

Freedom from turbulence in the mixed gas stream leaving the exit orifice of the tip.

An inner flame cone, which is defined, symmetrically, and steady burning, without fringes or streamers, and with the heat concentrated at the extreme end.

A steady flame that will "root" against the tip face, and may be adjusted over a wide pressure range before reaching either the blow-away point or the backfire region.

The flame itself may be either the "long" or "bulbous" type. The terms "long" and "bulbous" are used to describe the general appearance applied to the inner flame cone.

A long inner flame cone is one with its length equal to several times its diameter. The sides of the flame cone are straight, and its end is usually pointed, especially in small size tips.

A bulbous type flame cone is appreciably shorter in length. Its diameter increases somewhat after leaving the tip, and it has a rounded end so that its shape roughly resembles a miniature electric light bulb.

Either type of flame is efficient when properly applied, and the use of either depends primarily on the preference of the welder and the nature of the work to be accomplished.

Few bulbous flame tips are available today. The growth of the arc welding processes has limited acetylene gas welding to the maintenance, repair and service field and to small artisans.

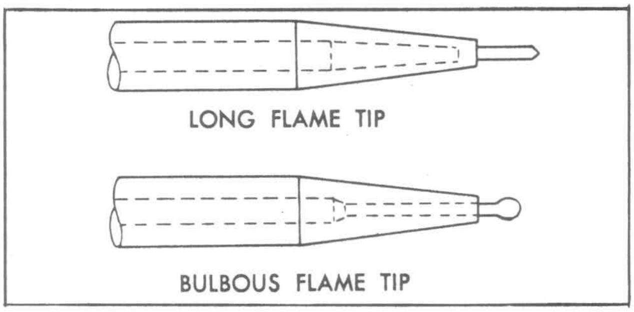
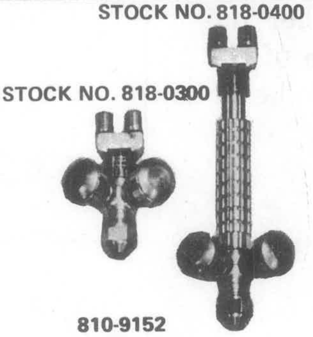


Figure G-7

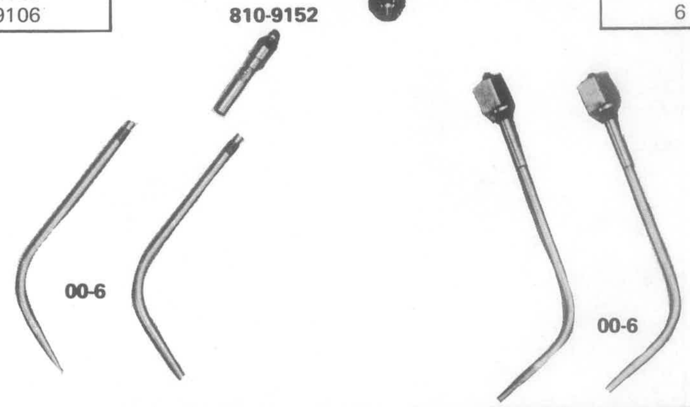
3. WELDING TIP ASSEMBLIES AND SEPARABLE TIPS

STYLES 300 AND 400 WELDING TORCH HANDLE FOR LIGHT-DUTY WELDING, BRAZING AND HEATING

STYLE 91 SEPARABLE TIPS	
00	810-9112
0	810-9111
1	810-9101
2	810-9102
3	810-9103
4	810-9104
5	810-9105
6	810-9106



STYLE 919 TIP & MIXER ASS'Y.	
00	810-9189
0	810-9190
1	810-9191
2	810-9192
3	810-9193
4	810-9194
5	810-9195
6	810-9196



APPLICATIONS

The Style 300 and 400 light-duty welding torches are designed for welding, brazing, and heating in the auto body and airplane repair, the air conditions and refrigeration, the appliance and metal furniture production as well as arts and crafts, jewelry and hobbies. They are used mainly with acetylene or MAPP® Gas. By means of an attachment steel cutting up to 3 inches thick can be performed.

DESCRIPTION

Style 300 weighs 5 ounces without tip, and Style 400 weighs 6 ounces. Both torches are equipped with "A" size inlet gas connections for 3/16 I.D. Hose. The valves are of the needle type for fine flame adjustment and are positioned near the front end of the handle.

WELDING AND BRAZING

Two styles of welding tips are available—one is the separable type tip Style 91 used with mixer 810-9152. The other style is the tip and mixer assembly Style 919. Both tip styles have size 00 to 6 to weld steel up to 3/8 inches thick with acetylene and up to 1/4 inches thick with MAPP Gas. For tip information refer to catalogs 810-811 pages 13 thru 18.

HEATING

Multi-flame heating tip stock number 810-0968 is a tip and tube assembly which fits the above 810-9152 mixer.

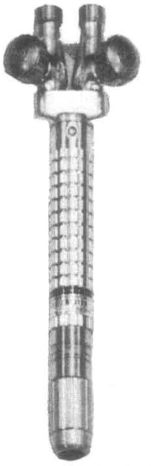
CUTTING

By addition of the Style 1490 cutting attachment and use of the Style 112 cutting tips for acetylene and Style 132 with MAPP® Gas, steel up to 3 inches thick can be cut.

Refer to catalog 810-811 for detail on welding tips and catalog 813 for cutting tips.

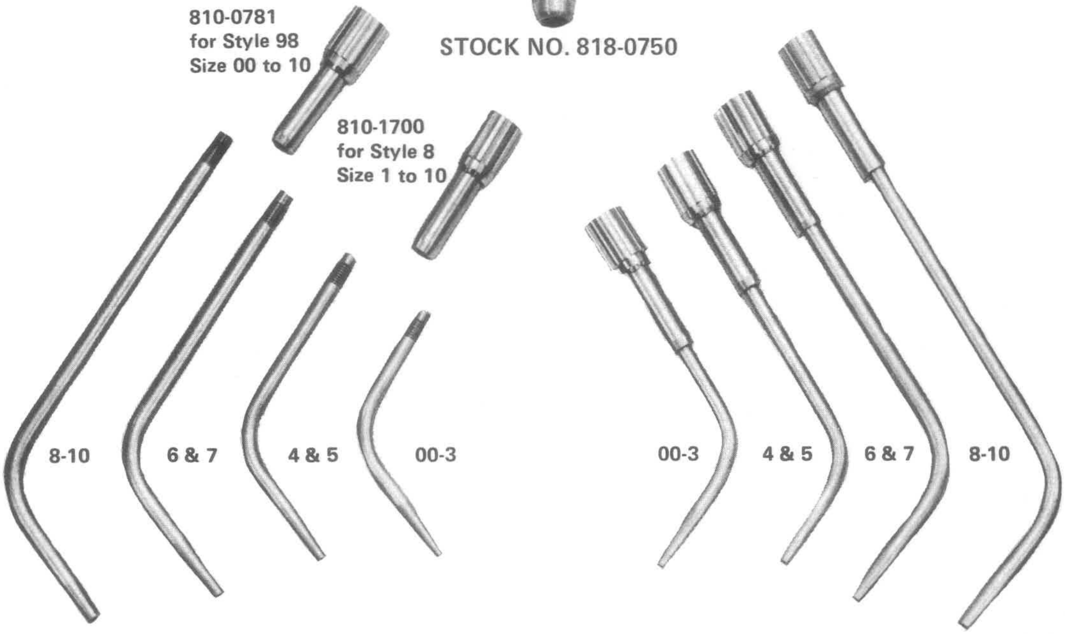
STYLE 750 WELDING TORCH HANDLE FOR MEDIUM DUTY APPLICATIONS

SEPARABLE TIPS			
STYLE 8		STYLE 98	
1	811-1081	00	811-9020
2	811-1082	0	811-9800
3	811-1083	1	811-9801
4	811-1084	2	811-9802
5	811-1085	3	811-9803
6	811-1086	4	811-9804
7	811-1087	5	811-9805
8	811-1088	6	811-9806
9	811-1089	7	811-9807
10	811-1090	8	811-9808
		9	811-9809
		10	811-9810



STOCK NO. 818-0750

TIP & MIXER ASSEMBLIES	
STYLE 70	
00	810-7020
0	810-7000
1	810-7001
2	810-7002
3	810-7003
4	810-7004
5	810-7005
6	810-7006
7	810-7007
8	810-7008
9	810-7009
10	810-7010



APPLICATIONS

Airco Style 750 welding torch is designed for medium duty welding, brazing, heating, and cutting application. Using either acetylene or MAPP® Gas for all applications or propane and natural gas for brazing, heating and cutting. It is well accepted in service and repair shops, construction, farms and industrial maintenance as well as metal fabrication.

This torch has a "B" size hose connection for either 1/4" or 5/16" I.D. hose. It weighs 16 ounces and has a flow capacity of 140 c.f.h. with acetylene and 70 c.f.h. with MAPP Gas for heating operations. With the Airco Style 3700 and 4700 cutting attachment and the appropriate cutting tip, this torch will cut up to 6 inches of thick steel.

Three styles of welding tips are available. Separable tip Style 98 made of 3/8" O.D. copper tube comes in size 00 to 10 and is used with mixer 810-0781. Style 8 is also a separable tip made of 7/16" O.D. tube. It comes in size 1 to 10 and is used with mixer 810-1700. Style 70 is a tip and mixer assembly made of 3/8" O.D. tube. It comes in size 00 to 10.

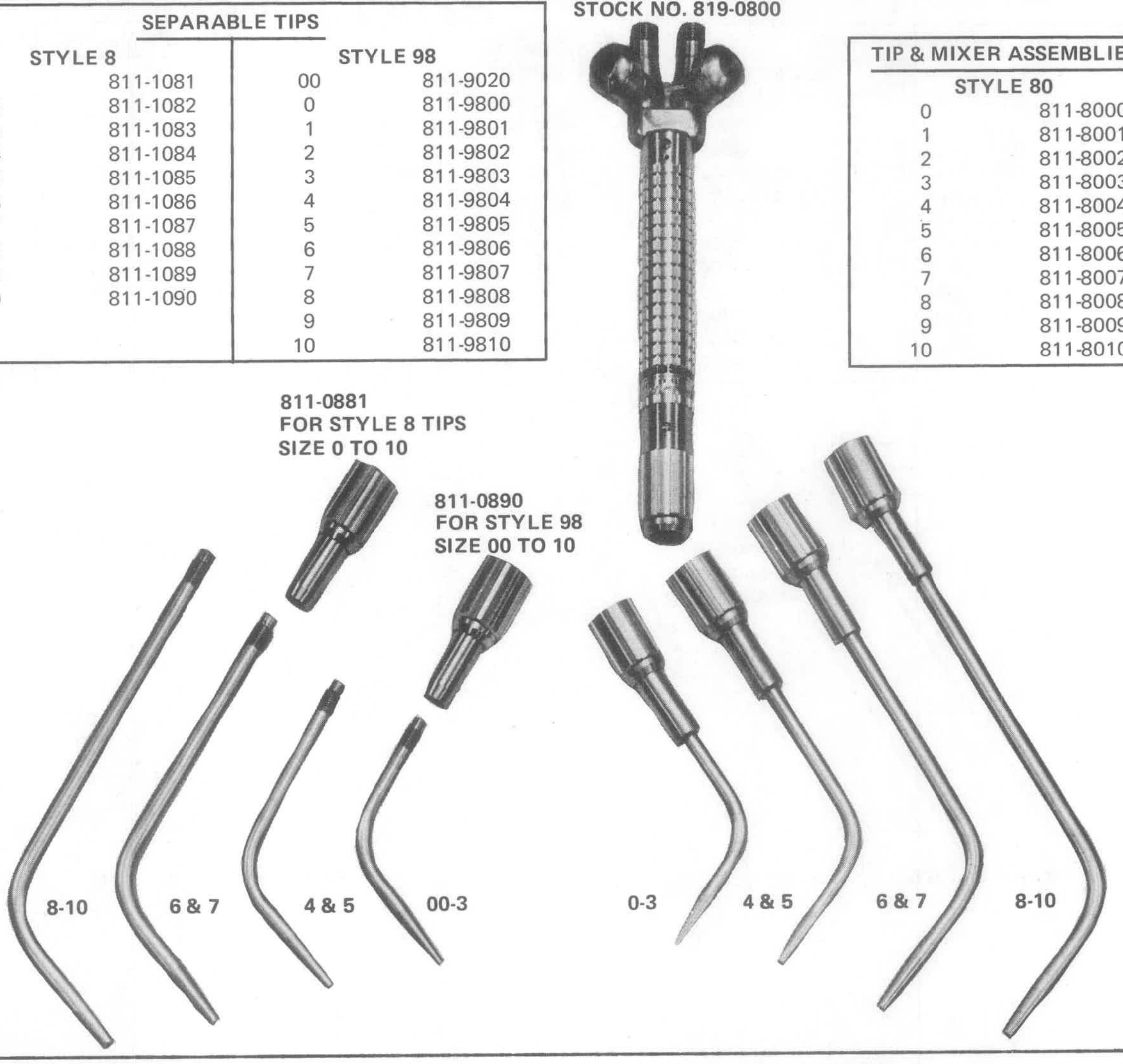
For extra heavy welding requiring a larger tip than single flame No. 10, we recommend the use of multi-flame tips.

Multi-flame heating tip assembly stock number 810-0890 is the largest capacity tip for the torch. Other separable tips, extension and mixers are shown in Catalog 810.

STYLE 800 WELDING TORCH HANDLE
FOR HEAVY DUTY WELDING, BRAZING, AND HEATING

SEPARABLE TIPS			
STYLE 8		STYLE 98	
1	811-1081	00	811-9020
2	811-1082	0	811-9800
3	811-1083	1	811-9801
4	811-1084	2	811-9802
5	811-1085	3	811-9803
6	811-1086	4	811-9804
7	811-1087	5	811-9805
8	811-1088	6	811-9806
9	811-1089	7	811-9807
10	811-1090	8	811-9808
		9	811-9809
		10	811-9810

TIP & MIXER ASSEMBLIES	
STYLE 80	
0	811-8000
1	811-8001
2	811-8002
3	811-8003
4	811-8004
5	811-8005
6	811-8006
7	811-8007
8	811-8008
9	811-8009
10	811-8010


STOCK NO. 819-0800

811-0881
FOR STYLE 8 TIPS
SIZE 0 TO 10

811-0890
FOR STYLE 98
SIZE 00 TO 10

APPLICATIONS

Style 800 heavy duty torch is among the highest flow capacity torch available. Designed for rough operations it is used mostly in steel fabrication, steel mill and heavy construction for descaling, hard facing, flame hardening, heavy multi-flame welding and heating with all fuels.

Three styles of welding tips are available. Separable tip Style 98 made of 3/8" O.D. copper tube comes in size 00 to 10 and is used with mixer 811-0890. Style 8 is also a separable tip made of 7/16" O.D. tube. It comes in size 1 to 10 and is used with mixer 811-0881. Style 80 is a tip and mixer assembly made of 7/16" O.D. tube. It comes in size 0 to 10.

For extra heavy welding requiring a larger tip than single flame No. 10, we recommend the use of multi-flame tips.

DESCRIPTION & PERFORMANCE

Style 800 torch weighs only 21 ounces to minimize operator's fatigue. It has shrouded valves with a stainless steel ball-type seating element for high flows. The flow capacity satisfies the largest multi-flame heating tips with flows of 550 c.f.h. for MAPP® Gas, 350 c.f.h. for propane, 675 c.f.h. for natural gas and 280 c.f.h. for acetylene.

MULTI-FLAME HEATING

Airco's Universal Heating Tip line fits the Style 800 torch "Universal" means that these tips can be used with all fuel gases. There is a choice of 11 sizes of tips and 6 extensions to meet all work conditions. Refer to Catalog 810-811, pages 1 to 8.1 for choice of heating tips.

CUTTING

Style 4800 cutting attachment designed to fit the Style 800 torch permits to cutting steel up to 8" thick. This attachment uses all Airco's standard 3/4" three-land tips for all fuel gases. Refer to Catalog 813 for standard tips and Master tips and to Catalog 822 for cutting attachment.

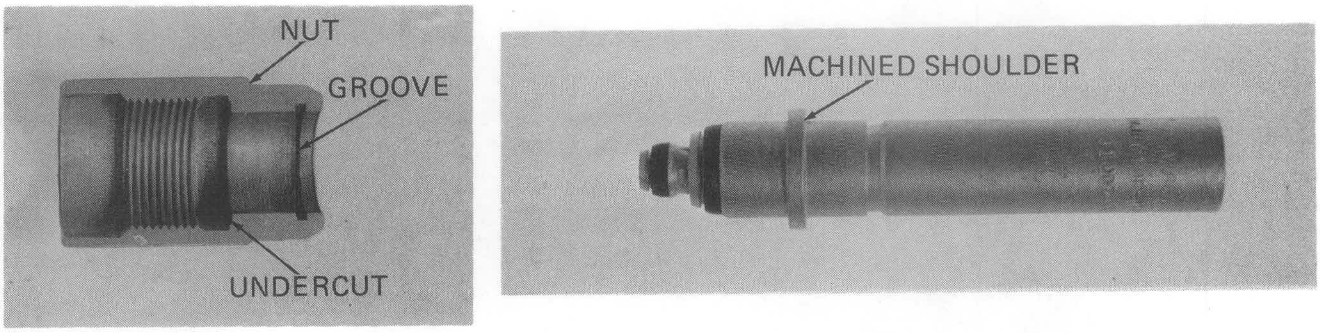
TIP NUTS, MIXERS AND WELDING TIPS

Mixers, tips, and tip-mixer assemblies, are held in place on the torch handle by a tip nut.

One is also supplied as part of each tip-mixer assembly and each cutting attachment. (A customer merely set aside the torch tip nut wherever he used a tip-mixer assembly or cutting attachment.) A recent design change required that all mixers also be supplied with new style tip nuts. Since your customer may have some of the older tip nuts and be ordering new parts, you may be asked to explain the details. The following is a brief explanation:

The old mixer had a machined shoulder. An undercut in the tip nut applied pressure against it (Fig. G-8). A stainless steel friction ring located in the nut groove created a friction against the mixer body and prevented the tip nut from falling off the mixer. With the new mixer design (which involved only external design changes) the machined shoulder of the old mixer was replaced with a hardened steel lock ring set into a groove. The new nut has no undercut or groove for a friction ring. Instead, it is retained by a retainer ring (nut retainer) located on the mixer's body. By using a new mixer with a nut designed for the old mixer it was not possible to make a proper connection. Because of the confusion created by old and new style tip nuts, it was decided to supply all mixers with a tip nut eliminating the possibility of using the wrong nut.

OLD DESIGN TIP NUT AND MIXER



NEW DESIGN TIP NUT AND MIXER

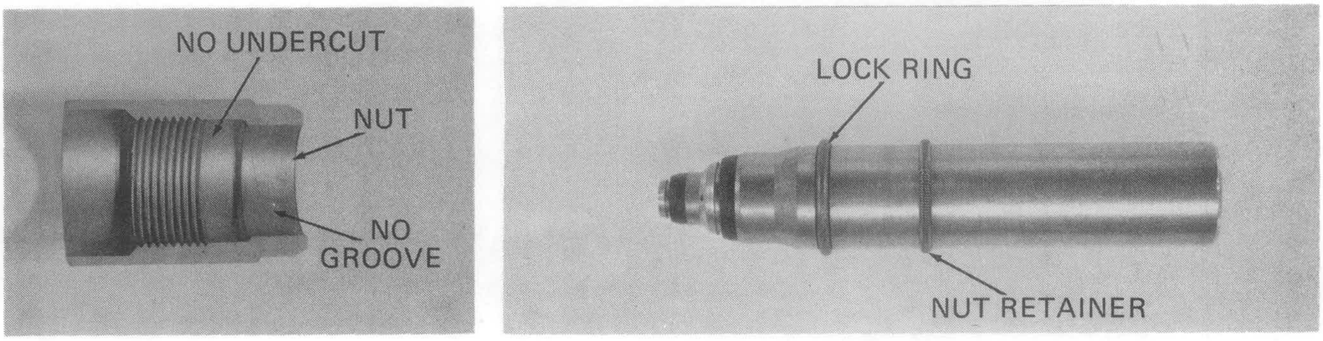


Figure G-8

MIXERS FOR WELDING TIPS

AIRCO GAS MIXERS FOR SEPARABLE WELDING TIPS NEW EXTERIOR DESIGN

Users who have discontinued separable tips will still be able to obtain mixers for them. However, the mixers have the new external design change and are supplied with a new tip nut 831-2890; see this page for listing of all Airco mixer and injector mixers available for welding and brazing.

FOR 800 SERIES WELDING TORCH

MIXER STOCK NUMBER	NEW TIP LINE		MIXER INTERNAL THREAD	COMMENTS	
	STYLE	SIZES			
811-0881	8	0-10	7/16-20	811-0389 Adaptor Tips fit directly on mixer 811-0493 Adaptor	Airco's unparalleled "Jet Mixer" has stability and performance for the entire range of sizes for welding and heating operations.
811-0890	98	0-10	3/8-20		
811-0899	8	0-10	adapt 1/2-20		
	98	0-10	adapt.		
New tip nut 831-2891 supplied with each mixer listed above.					

FOR 700 & 750 SERIES WELDING TORCHES

MIXER STOCK NUMBER	NEW TIP LINE		MIXER INTERNAL THREAD	COMMENTS
	STYLE	SIZES		
810-0780	98	00-5	3/8-20	No Major Changes
810-0781	98	0-10	3/8-20	
810-1700	8	0-10	7/16-20	

New tip nut 831-2890 is supplied with each mixer listed above.

FOR 300 & 400 SERIES WELDING TORCHES

MIXER STOCK NUMBER	NEW TIP LINES		MIXER INTERNAL THREAD	COMMENTS
	STYLE	SIZES		
810-9152	91	00-6	1/4-32	Minor change in internal design. Tip size range increased from the 5 to 6.
810-9172	91	00-6	1/4-32	Semi-injector for all fuel gases at low-pressure no design change.
	Minor design change. The mixers do not include a tip nut			

MIXER REPLACEMENT PARTS

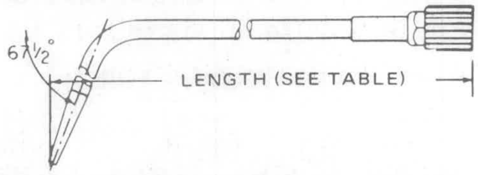
MIXER STOCK NO.	SEALING "O" RINGS		LOCK RINGS	TIP NUT RETAINING RINGS
	SMALL SEAL	LARGE RING		
810-9152 810-9172	810-0531	810-0530	none	830-1306
810-0780 810-0781 810-1700	810-0411	810-0412	810-2013	810-2010
811-0899 811-0890-0913 811-1800-0881	811-0897	811-0896	810-2005	810-2011 810-2011 810-2011

Style 70 Long Flame Tip Mixer Assemblies For Torch Handle Style 700 & 750

These assemblies include a welding tip, a matched mixer, neoprene gas sealing rings and a tip nut. The matched mixer assures better flame control for producing sound welds.

The Style 70 tip and mixer assembly fits the medium duty 750 series torch. Tips are made of 3/8" O.D. heavy wall copper tube.

This style comes in size 00 to 10.



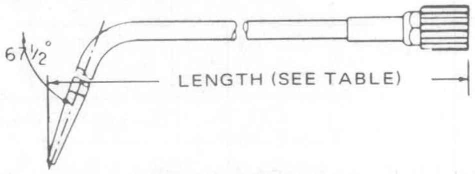
Stock No.	Tip Size	Drill Size	Length	Minimum Hose Dia.	ACETYLENE*		MAPP® GAS**	
					PSI	CFH	PSI	CFH
810-7020	00	#76 (.020)	6-3/8"	3/16"	1-1/2-6	1-3		
810-7000	0	#72 (.025)	6-3/8"	3/16"	1-1/2-6	2-5		
810-7001	1	#68 (.031)	6-3/8"	3/16"	1-1/2-6	2-7	1	1
810-7002	2	#62 (.038)	6-3/8"	3/16"	2-7	3-11	1-1/2	1-1/2
810-7003	3	#56 (.047)	6-3/8"	3/16"	2-10	5-19	1-1/2	2
810-7004	4	#54 (.055)	7-7/8"	3/16"	2-10	7-29	2	4
810-7005	5	#51 (.067)	7-7/8"	3/16"	2-10	10-39	2-1/2	8
810-7006	6	#48 (.076)	9-1/2"	1/4"	3-10	21-82	2-1/2	12
810-7007	7	#44 (.086)	9-1/2"	1/4"	3-10	25-74	3	16
810-7008	8	#40 (.098)	11-3/4"	1/4"	3-10	29-86	4	22
810-7009	9	#35 (.110)	11-3/4"	1/4"	3-10	31-99	6	28
810-7010	10	#30 (.128)	11-3/4"	5/16"	3-10	36-140	6	36

Style 80 Long Flame Tip Mixer Assemblies For Torch Handle Style 800

These assemblies include a welding tip, a matched mixer, neoprene gas sealing rings and a tip nut. The matched mixer assures better flame control for producing sound welds.

The Style 80 tips and mixer assembly fits the heavy duty 800 series torch. Tips are made of 7/16" O.D. heavy wall copper tube.

This style comes in size 0 to 10.



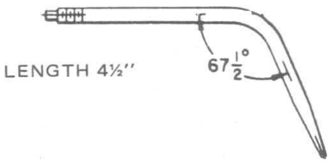
STYLE 80 LONG FLAME TIP MIXER ASSEMBLIES					ACETYLENE*		MAPP® GAS**	
Stock No.	Tip Size	Drill Size	Length	Minimum Hose Dia.	Pressure Range (PSIG)	Flow SCFH	Pressure* Range (PSIG)	Flow SCFH
811-8000	0	#72 (.025)	6-7/8"	3/16"	2-10	2-4	–	–
811-8001	1	#68 (.031)	6-7/8"	3/16"	2-10	3-6	1	1
811-8002	2	#62 (.038)	6-7/8"	3/16"	2-10	4-8	1½	1½
811-8003	3	#56 (.047)	6-7/8"	3/16"	2½-10	5-13	1½	2
811-8004	4	#54 (.055)	8-1/8"	3/16"	2½-10	6-15	2	4
811-8005	5	#51 (.067)	8-1/8"	3/16"	2½-10	11-29	2¼	8
811-8006	6	#48 (.076)	8-7/8"	1/4"	3-10	21-62	2½	12
811-8007	7	#44 (.086)	8-7/8"	1/4"	3-10	25-74	3	16
811-8008	8	#40 (.098)	10-7/8"	1/4"	3-10	29-86	4	22
811-8009	9	#35 (.110)	10-7/8"	1/4"	3-10	31-99	6	28
811-8010	10	#30 (.128)	10-7/8"	5/16"	3-10	39-140	6	36

* WHERE FLOWS EXCEED 50 CFH, TWO OR MORE MANIFOLDED ACETYLENE CYLINDERS SHOULD BE USED

** Pressures and flows with torch valves wide open.

WELDING AND BRAZING SEPARABLE TIPS

Style 91 Long-Flame-Type Welding Tips For Torch Handle Styles 300 and 400



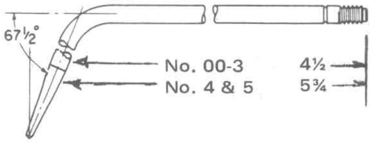
The Style 91 fits the 300 and 400 series torches by means of mixer 810-9152. Made of heavy wall 1/4" O.D. tube it comes in size 00 to 6. For medium and light welding and brazing.

Stock No.	Tip Size	Drill Size	ACETYLENE* Pressure	ACETYLENE* Flow	MAPP® GAS** Pressure	MAPP® GAS** Flow
810-9112	00	#76 (.020)	2 to 9	1.3 to 3.0	–	–
810-9111	0	#72 (.025)	2 to 10	1.7 to 3.7	–	–
810-9101	1	#68 (.031)	2 to 10	2.2 to 5.4	.5	1
810-9102	2	#62 (.038)	2 to 11	2.5 to 7.0	.6	1-1/2
810-9103	3	#56 (.047)	2 to 11	4.5 to 11.0	.7	2
810-9104	4	#54 (.055)	2 to 11	5.6 to 14.4	1.5	4
810-9105	5	#51 (.067)	2 to 11	10.0 to 26.0	2.5	8
810-9106	6	#48 (.076)	3 to 11	17.0 to 37.0	4	12

Style 98 Long-Flame-Type Welding Tips For Torch Handle Styles 750 and 800

These tips produce a long reaching type of flame that provides good heat concentration. Ideal for light and medium welding and many jobs where a long reaching flame is required.

The Style 98 fits both the 750 and 800 series torches by means of mixer 810-0780 for the 750 torch and mixer 811-1800 for the 800 torch. Made of heavy wall 3/8" O.D. tube it comes in size 00 to 5. For larger sizes use Style 8 Tips.

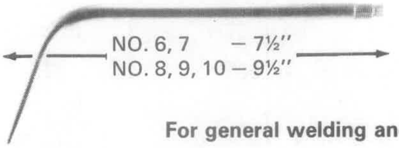


STYLE 98 – LONG FLAME WELDING TIP					ACETYLENE*		MAPP GAS**	
Stock No.	Tip Size	Drill Size	Thread Size	Minimum Hose Dia.	Pressure Range (PSIG)	Flow SCFH	Pressure* PSIG	Flow SCFH
811-9820	00	#76 (.020'')	3/8''-20M	3/16''	1½-6	1-3	–	–
811-9800	0	#72 (.025'')	''	3/16''	1½-6	2-5	–	–
811-9801	1	#68 (.031'')	''	3/16''	1½-7	2-7	1½	1
811-9802	2	#62 (.038'')	''	3/16''	2-7	3-11	1½	2
811-9803	3	#56 (.047'')	''	3/16''	2-10	5-19	2½	5
811-9804	4	#54 (.055'')	''	3/16''	2-10	7-29	2½	12
811-9805	5	#51 (.067'')	''	3/16''	2-10	10-39	3½	16
811-9806	6	#48 (.0760'')	''	1/4''	3-10	21-50	2½	12
811-9807	7	#44 (.0860'')	''	1/4''	3-10	25-60	3	16
811-9808	8	#40 (.0980'')	''	1/4''	3-10	29-72	4	22
811-9809	9	#35 (.1100'')	''	1/4''	3-10	31-78	6	28
811-9810	10	#30 (.1285'')	''	1/4''	3-10	36-84	6	36

Style 8 Long-Flame-Type Welding Tips For Torch Handle Styles 750 and 800

These tips produce a long reaching type of flame that provides good heat concentration. Ideal for light and medium welding and many applications where a long reaching flame is required.

The Style 8 fits both the 750 and 800 series Torches by means of mixer 810-1700 for the 750 torch and mixer 811-0881 for the 800 torch. Made of heavy wall 7/16" tube it comes in size 1 to 10.



For general welding and brazing

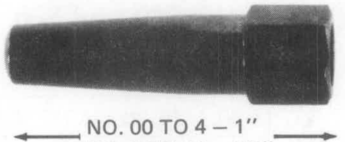
STYLE 8 — LONG FLAME WELDING TIP					ACETYLENE*		MAPP® GAS**	
STOCK NO.	TIP SIZE	DRILL SIZE	THREAD SIZE	MINIMUM HOSE DIA.	PRESSURE RANGE (PSIG)	FLOW SCFH	PRESSURE (PSIG)	FLOW SCFH
811-1081	#1	#68 (.031)	7/16-20M	¼"	1½-7	2-7	1	1
811-1082	#2	#62 (.038)	7/16-20M	¼"	2-7	3-11	1½	1½
811-1083	#3	#56 (.047)	7/16-20M	¼"	2-10	5-19	1½	2
811-1084	#4	#54 (.055)	7/16-20M	¼"	2-10	7-29	2	4
811-1085	#5	#51 (.067)	7/16-20M	¼"	2-10	10-39	2½	8
811-1086	#6	#48 (.076)	7/16-20M	¼"	3-10	21-62	2½	12
811-1087	#7	#44 (.086)	7/16-20M	¼"	3-10	25-74	3	16
811-1088	#8	#40 (.098)	7/16-20M	¼"	3-10	29-86	4	27
811-1089	#9	#35 (.110)	7/16-20M	¼"	3-10	31-99	5	28
811-1090	#10	#30 (.128)	7/16-20M	5/16"	3-10	36-140	6	36

*WHERE FLOWS EXCEED 50 CFH, TWO OR MORE MANIFOLDED ACETYLENE CYLINDERS SHOULD BE USED
**Pressures and flows with torch valves wide open.

Style 9 Separable Style Bulbous Flame Tips For Torch Handle Styles 750 and 800

These tips have a bulbous type of flame and they are perfect for silver brazing inaccessible joints by means of 10" flexible extension numbers 811-0434. Ideal for plumbers and pipe fitters on Walseal, Flagg, or other types of flow fittings, and in the refrigeration industry. Also ideal for applying heat to hard-to-get-at locations.

Available in tip sizes 00 through 10, covering flow up to 83 c.f.h. of acetylene. Stock numbers 811-0920 and 811-0900-0910. These tips fit the 750 and 800 series torches.



For Silver brazing

STYLE 9 — SEPARABLE BULBOUS FLAME TIPS							
STOCK NO.	TIP SIZE	FUEL GAS	FLAME PATTERN	PRESSURE RANGE P.S.I.*	FUEL GAS FLOW RANGE C.F.H.	MINIMUM HOSE SIZF	
						3/16	1/4
			Bulbous				
811-0900	00	Acety.	Separable Type	1½-5	1-3	↓	↓
811-0920	0	Acety.	Separable Type	1½-5	2-4	↓	↓
811-0901	1	Acety.	Separable Type	1½-5	2-6	↓	↓
811-0902	2	Acety.	Separable Type	2-5	2.5-8	↓	↓
811-0903	3	Acety.	Separable Type	2-5	4-12	↓	↓
811-0904	4	Acety.	Separable Type	2-6	6-18	↓	↓
811-0905	5	Acety.	Separable Type	2-6	10-30	↓	↓
811-0906	6	Acety.	Separable Type	3-7	17-37	↓	↓
811-0907	7	Acety.	Separable Type	3-9	20-53		↓
811-0908	8	Acety.	Separable Type	3-9	27-64		↓
811-0909	9	Acety.	Separable Type	3-9	31-72		↓
811-0910	10	Acety.	Separable Type	3-10	36-83		↓

WELDING AND BRAZING TIP MIXER ASSEMBLIES

The following is the recommended tip size for the applicable material thickness and gas service for all of the welding and brazing tips.

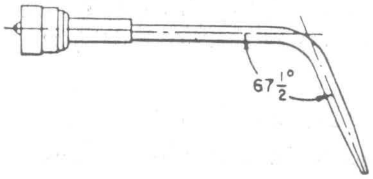
WELDING TIP SIZE vs MATERIAL THICKNESS

TIP SIZES	#00	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
ACETYLENE	1/64	1/32	1/16	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4 & Up
MAPP GAS		1/64	1/32	1/16	3/32	1/8	3/16	1/4				

Style 919 Long-Flame Tip-Mixer Assemblies For Torch Handles Style 300 and 400

These tips are ideal for very light welding and brazing operations in the auto body, air conditioning and refrigeration, the appliance and metal furniture production as well as arts and crafts, jewelry and hobbies.

The Style 919 tip mixer assembly fits the light duty 300 and 400 series torches. Tips are made of 1/4" O.D. heavy wall copper tube. This style comes in size 00 to 6 to weld steel up to 3/8" thick with acetylene and up to 1/4" thick with MAPP® Gas. Recommended hose I.D. diameter 3/16".



			ACETYLENE		MAPP® GAS	
STOCK NO.	TIP SIZE	DRILL SIZE	PRESSURE	FLOW	PRESSURE	FLOW
810-9189	00	#76 (.020)	2 to 9	1.3 to 3.0	–	–
810-9190	0	#72 (.025)	2 to 10	1.7 to 3.7	–	–
810-9191	1	#68 (.031)	2 to 10	2.2 to 5.4	.5	1
810-9192	2	#62 (.038)	2 to 11	2.5 to 7.0	.6	1-1/2
810-9193	3	#56 (.047)	2 to 11	4.5 to 11.0	.7	2
810-9194	4	#54 (.055)	2 to 11	5.6 to 14.4	1.5	4
810-9195	5	#51 (.067)	2 to 11	10.0 to 26.0	2.5	8
810-9196	6	#48 (.076)	3 to 11	17.0 to 37.0	4	12

4. AIRCO HEATING TIP LINE

UNIVERSAL TIPS

The Airco Universal heating tip line is about five years old. It is the most flexible and compact line of heating tips on the market. It consists basically of three tip styles. Two styles are of the separable type, the other consists of tip and tube assemblies. The line also includes a good selection of tip extensions. The tips can be used with any of the current fuel gases.

The separable type Style 756 includes five sizes 5, 7, 8, 9, and 10. Style 757, also of the separable type, includes six sizes 12, 13, 14, 16, 17 and 18. The Style 756 tip and tube assemblies consists of sizes 10, 12, 13 and 14.

The three largest sizes 16, 17 and 18 are not to be used with acetylene. The warning is stamped on the tip. Because of the pressure limitation of acetylene it would be difficult to obtain an adequate flow for efficient operation.

With the advent of the Airco Universal heating tip line, a brochure on the subject of heating was prepared, (Airco literature reference ADC 1148). The essential details of heating are included in the brochure, including complete flow data. It is a part of this product information manual.

OTHER HEATING TIPS

In addition to the Universal line, there are three other heating tips. Style 842 is a tip and mixer assembly for the Style 800 torch. It is a size 10.

Style 742 is also a size 10 tip. It is a tip and mixer assembly for Style 750 torch.

Style 754 is a size 8. It is a tip and tube assembly for the Style 400 torch.

Five special styles for acetylene use complete the line.

Tips on tips

You get best heating results when you look beyond your tip. Ensure an adequate gas supply. Use the right size regulators and tip. Install check valves in the torch. Then adjust your settings with operating charts to maximize fuel economy.

Gas Supply — Use fuel pressures of at least 10 p.s.i.g. for high velocity flames. For big tips and big heating jobs, you may need up to 35 p.s.i.g. If single cylinders won't deliver it to you, manifold them. Use regulators with adequate capacity for your job. Where flow rates are unusually high, use 3/8-in. dia. hose. Make sure the hose is short as possible and has a minimum number of couplings. Use size "B" hose fittings with a flow passage of at least 1/4-in. dia.

Safety — Install Airco size "B" check valves at the torch. Some competitive check valves are restrictive and will starve your gas flow. Be careful. The valves you install should have a minimum hole diameter of 1/4-in. They will prevent reverse gas flow. If you have a smaller torch, use size "A" check valves with a flow passage of at least 0.100 in. dia. Here's a useful guide:

AIRCO CHECK VALVES

Size	Gas	Stock Number
"B"	Oxygen	831-2636
"B"	Fuel	831-2635
"A"	Oxygen	831-2770
"A"	Fuel	831-2771

Select the best tip size — You can burn up a lot of fuel in a short time with high-velocity flames, and the wrong tip size. A tip that burns 200 c.f.h. won't necessarily heat twice as fast as one burning 100 c.f.h. Minimize your fuel costs by trying different tip sizes and comparing fuel consumption. If flow meters aren't available, use pressure gauges with inline adapters (Airco size "B" only — Stock No. 831-2840 for oxygen, No. 831-2841 for fuel). Then multiply the cubic feet per hour of fuel used by the time required to complete the job.

If neither flow rate meters nor pressure gauges are available, the primary flame cone lengths listed in the tables on the next two pages and in the brochure ADC 1148 will provide a rough check on proper flow rate for each tip. And always check pressure at the torch, not at the regulators. Your hose may have leaks or pressure drops due to obstructions. The test will show that.

Use recommended flow rates — Flame velocity is important for optimum heat transfer to a workpiece. We have also provided you with optimum fuel settings in the tables. Our tips are rated on these high-efficiency settings. Sometimes you will see the outer ring of a high-velocity flame anchored only on the inside-edge of the flame port when using these settings. This is a normal condition for a high-velocity flame. If more heat is desired, use a larger tip. If you want less heat, use a smaller tip.

Operating with MAPP Gas — It's more economical to use an oxidizing 4-to-1 oxygen-to-MAPP Gas ratio than a neutral 2.5-to-1 flame when the workpiece permits, and all you want to do is heat it. This setting will give you maximum heating efficiency. However, use a neutral flame for heating molten metal or an easily oxidized workpiece. The reason why you should use oxidizing settings for MAPP Gas is simple. Take a No. 10 Universal Tip and operate it on 50 c.f.h. of oxy-MAPP Gas at 4-to-1 fuel ratio. It will deliver as much heat as 70 c.f.h. oxy-MAPP Gas at a 2.5-to-1 ratio. And you will save money.

When you need a soft flame — Low-velocity (soft) flames are best for soldering or brazing, welding or soaking heat into large castings. You get a soft flame simply by operating at flow rates below those recommended for high-velocity flames. Universal Tips also give efficient heating with soft natural gas flames, even when line pressure is low. However, when using a soft, bushy flame, try to avoid backwash over your tip. You can burn any tip, including the Universal Heating Tip, if you submerge it in flame at low flow rates.

OXYGEN/PROPANE

RATIO – 4:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURES (PSIG)*										PRI-MARY CONE LGTH. (IN.)	QTY. OF 100 LB. CYL. REQ'D FOR CONT. OPER.**	EFFICIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25-FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & MIXER STOCK NO.						STYLE 750 TORCH & MIXER STOCK NO. 810-0781		STYLE 400 TORCH & MIXER STOCK NO. 810-9152						
		811-0899		811-0891		811-0881 811-0890										
		Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy					
759/7	810-0977	7	10	5	10	7	14	7	14	9	20	1/2	1	15	3/16	7 – 67
759/8	810-0978	8	12	6	11	10	20	10	22	18	37	1/2	2	25	1/4	7 – 63
759/9	810-0979	9	15	8	14	13	33	11	37	–	–	1/2	2	40	1/4	7 – 56
759/10	810-0980	10	16	9	15	20	43	16	46	–	–	1/2	3	50	5/16	7 – 55
742/10	810-0890	–	–	–	–	–	–	20	45	–	–	1/2	3	50	5/16	7 – 55
756/10	811-1910	10	16	–	–	–	–	–	–	–	–	1/2	3	50	5/16	7 – 55
756/12	811-1912	8	26	–	–	–	–	–	–	–	–	3/4	4	70	5/16	12 – 56
756/13	811-1913	9	40	–	–	–	–	–	–	–	–	3/4	5	110	3/8	12 – 54
756/14	811-1914	10	54	–	–	–	–	–	–	–	–	3/4	8	150	3/8	19 – 55
842/12	811-1690	8	18	–	–	–	–	–	–	–	–	3/4	4	70	5/16	12 – 56
757/12	811-2032	8	18	–	–	–	–	–	–	–	–	3/4	4	70	5/16	12 – 56
757/13	811-2033	9	40	--	–	–	–	–	–	–	–	3/4	5	110	3/8	12 – 54
757/14	811-2034	10	54	–	–	–	–	–	–	–	–	3/4	8	150	3/8	19 – 55
757/16	811-2036	17	96	–	–	–	–	–	–	–	–	1	15	250	3/8	27 – 54
757/17	811-2037	20	108	–	–	–	–	–	–	–	–	1	20	300	3/8	27 – 53
757/18	811-2038	22	120	–	–	–	–	–	–	–	–	1	23	350	3/8	37 – 1/16

*Torch inlet pressures given only as a guide to set regulators—with torch valves wide open; and to check restrictions in fuel or oxygen supply systems. Oxygen/fuel ratio is set to flame appearance—when primary cones of length listed above are the shortest obtainable as ratio is varied.

**Use cylinders with manifold; use until 10% full at 70°F.

OXYGEN/NATURAL GAS (Positive Pressure)

RATIO – 2:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURES (PSIG)*										PRI-MARY CONE LGTH. (IN.)	QTY. OF CYL. REQ'D FOR CONT. OPER.	EFFICIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25-FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & MIXER STOCK NO.						STYLE 750 TORCH & MIXER STOCK NO. 810-0781		STYLE 400 TORCH & MIXER STOCK NO. 810-9152						
		811-0899		811-0891		811-0881 811-0890										
		Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy					
759/7	810-0977	1.5	3	2	3	2	8	2	8	2	9	1/4	1	15	3/16	7 – 67
759/8	810-0978	3.5	8	3.5	7	4	10	4	11	8	22	1/2	1	30	1/4	7 – 63
759/9	810-0979	5	12	6	10	9	20	8	23	–	–	1/2	1	60	1/4	7 – 56
759/10	810-0980	7	15	7	12	14	30	13	35	–	–	1/2	1	80	5/16	7 – 55
742/10	810-0890	–	–	–	–	–	–	13	40	–	–	1/2	1	80	5/16	7 – 55
756/10	811-1910	7	15	–	–	–	–	–	–	–	–	1/2	1	80	5/16	7 – 55
756/12	811-1912	8	22	–	–	–	–	–	–	–	–	3/4	1	40	5/16	12 – 56
756/13	811-1913	9	38	–	–	–	–	–	–	–	–	3/4	1	210	3/8	12 – 54
756/14	811-1914	11	50	–	–	–	–	–	–	–	–	3/4	1	280	3/8	19 – 55
842/12	811-1690	10	20	–	–	–	–	–	–	–	–	3/4	1	140	5/16	12 – 56
757/12	811-2032	8	22	–	–	–	–	–	–	–	–	3/4	1	140	5/16	12 – 56
757/13	811-2033	9	38	–	–	–	–	–	–	–	–	3/4	1	210	3/8	12 – 54
757/14	811-2034	11	50	–	–	–	–	–	–	–	–	3/4	1	280	3/8	19 – 55
757/16	811-2036	20	88	–	–	–	–	–	–	–	–	1	1	475	3/8	27 – 54
757/17	811-2037	24	112	–	–	–	–	–	–	–	–	1	1	575	3/8	27 – 53
757/18	811-2038	26	120	–	–	–	–	–	–	–	–	1	1	675	3/8	37 – 1/16

*Torch inlet pressures given only as a guide to set regulators—with torch valves wide open; and to check restrictions in fuel or oxygen supply systems. Oxygen/fuel ratio is set to flame appearance—when primary cones of length listed above are the shortest obtainable as ratio is varied.

OXYGEN/NATURAL GAS (Low Pressure)

RATIO – 2:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURE* (PSIG) (ONLY OXYGEN REQUIRED)					PRIMARY CONE LGTH. (IN.)	NO CYL.; PIPE LINE @ 6 IN. H_2O PRESS.	EFFI-CIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25 FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & INJECTOR MIXER STOCK NO.			STYLE 750 TORCH & INJECTOR MIXER STOCK NO.						
		811-1423	811-1422	811-1421	810-0714	810-0713					
		Oxy	Oxy	Oxy	Oxy	Oxy					
759/7	810-0977	–	–	100	20	85	1/4	↓	15	1/4	7 – 67
759/8	810-0978	–	–	105**	50	110**	1/2		30	1/4	7 – 63
759/9	810-0979	–	55	–	100	–	1/2		60	1/4	7 – 56
759/10	810-0980	–	75	–	100	–	1/2		80	5/16	7 – 55
742/10	NOT FOR LOW PRESSURE – POSITIVE PRESSURE ONLY										
756/10	811-1910	–	75	–	100	–	1/2	↓	80	5/16	7 – 55
756/12	811-1912	–	85	–	–	–	3/4		110	5/16	12 – 56
756/13	811-1913	–	115	–	–	–	3/4		135	3/8	12 – 54
756/14	811-1914	70	–	–	–	–	3/4		150	3/8	19 – 55
842/12	NOT FOR LOW PRESSURE – POSITIVE PRESSURE ONLY										
757/12	811-2032	–	85	–	–	–	3/4	↓	110	5/16	12 – 56
757/13	811-2033	–	115	–	–	–	3/4		135	3/8	12 – 54
757/14	811-2034	70	–	–	–	–	3/4		150	3/8	19 – 55
757/16	811-2036	85	–	–	–	–	3/4		170	3/8	27 – 54
757/17 757/18	TOO LARGE FOR INJECTOR OPERATION										

*Torch inlet pressures given only as a guide to set regulator—with torch valves wide open; and to check restrictions in oxygen supply system. Oxygen/fuel ratio is set to flame appearance—when primary cones of length listed above are the shortest obtainable as the ratio is varied. Use check valves for safety; use oxygen test gauge for pressure at torch.

**Fuel rate will go no higher than 20 cfh.

. . .USE THE RIGHT FUEL SETTINGS

OXYGEN/ACETYLENE

RATIO – 1.1:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURES (PSIG)*										PRI-MARY CONE LGTH. (IN.)	QTY. OF NO. 5 CYL. REQ'D FOR CONT. OPER. **	EFFICIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25-FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & MIXER STOCK NO.						STYLE 750 TORCH & MIXER STOCK NO. 810-0781		STYLE 400 TORCH & MIXER STOCK NO. 810-9152						
		811-0899		811-0891		811-0881 811-0890										
		Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy					
759/7	810-0977	10	12	11	13	10	14	10.5	15	15	18	1/2	1	50	3/16	7 – 67
759/8	810-0978	10	12	11	13	11.5	16	11.5	15	–	–	1/2	2	70	1/4	7 – 63
759/9	810-0979	10	12	10	12	15	21	15	22.5	–	–	1/2	2	110	1/4	7 – 56
759/10	810-0980	10	12	12	15	–	–	–	–	–	–	1/2	3	140	5/16	7 – 55
742/10	810-0890	–	–	–	–	–	–	15	22.5	–	–	1/2	3	140	5/16	7 – 55
756/10	811-1910	10	12	–	–	–	–	–	–	–	–	1/2	3	140	5/16	7 – 55
756/12	811-1912	10	19	–	–	–	–	–	–	–	–	1/2	3	175	5/16	12 – 56
756/13	811-1913	10.5	20	–	–	–	–	–	–	–	–	1/2	4	230	3/8	12 – 54
756/14	811-1914	11	22	–	–	–	–	–	–	–	–	1/2	5	275	3/8	19 – 55
842/12	811-1690	10	15	–	–	–	–	–	–	–	–	1/2	3	175	5/16	12 – 56
757/12	811-2032	10	19	–	–	–	–	–	–	–	–	1/2	3	175	5/16	12 – 56
757/13	811-2033	10.5	20	–	–	–	–	–	–	–	–	1/2	4	230	3/8	12 – 54
757/14	811-2034	11	22	–	–	–	–	–	–	–	–	1/2	5	275	3/8	19 – 55
Tips No. 16, 17 & 18		Not for acetylene use. They tend to overheat and burn out because they can not get enough fuel.														

*Torch inlet pressures given only as a guide to set regulators—with torch valves wide open; and to check restrictions in fuel or oxygen supply systems. Oxygen/fuel ratio is set to flame appearance—when feather just disappears from primary cones of length listed above (neutral flame).

**Use cylinders with manifold.

OXYGEN/MAPP® GAS (Neutral Flame)

RATIO – 2.5:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURES (PSIG)*										PRI-MARY CONE LGTH. (IN.)	QTY. OF 115 LB. CYL. REQ'D FOR CONT. OPER. **	EFFICIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25-FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & MIXER STOCK NO.						STYLE 750 TORCH & MIXER STOCK NO. 810-0781		STYLE 400 TORCH & MIXER STOCK NO. 810-9152						
		811-0899		811-0891		811-0881 811-0890										
		Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy					
759/7	810-0977	6	9	8	14	9	15	9	16	14	27	9/16	1	25	3/16	7 – 67
759/8	810-0978	9	12	10	15	11	20	11	21	22	38	9/16	1	35	1/4	7 – 63
759/9	810-0979	10	15	10	15	14	30	12	32	–	–	9/16	2	55	1/4	7 – 56
759/10	810-0980	11	18	10	16	22	38	20	38	–	–	9/16	2	70	5/16	7 – 55
742/10	810-0890	–	–	–	–	–	–	23	40	–	–	9/16	2	70	5/16	7 – 55
756/10	811-1910	11	18	–	–	–	–	–	–	–	–	9/16	2	70	5/16	7 – 55
756/12	811-1912	9	20	–	–	–	–	–	–	–	–	3/4	3	100	5/16	12 – 56
756/13	811-1913	10	35	–	–	–	–	–	–	–	–	3/4	4	150	3/8	12 – 54
756/14	811-1914	13	44	–	–	–	–	–	–	–	–	3/4	6	200	3/8	19 – 55
842/12	811-1690	9	15	–	–	–	–	–	–	–	–	3/4	3	100	5/16	12 – 56
757/12	811-2032	9	20	–	–	–	–	–	–	–	–	3/4	3	100	5/16	12 – 56
757/13	811-2033	10	35	–	–	–	–	–	–	–	–	3/4	4	150	3/8	12 – 54
757/14	811-2034	13	44	–	–	–	–	–	–	–	–	3/4	6	200	3/8	19 – 55
757/16	811-2036	17	72	–	–	–	–	–	–	–	–	3/4	10	300	3/8	27 – 54
757/17	811-2037	22	92	–	–	–	–	–	–	–	–	1	12	370	3/8	27 – 53
757/18	811-2038	32	120	–	–	–	–	–	–	–	–	1	25	550	3/8	37 – 1/16

*Torch inlet pressures given only as a guide to set regulators—with torch valves wide open; and to check restrictions in fuel or oxygen supply systems. Oxygen/fuel ratio is set to flame appearance—when feather just disappears from primary cones of length listed above (neutral flame).

**Use cylinders with manifold; use until 10% full.

OXYGEN/MAPP® GAS (Oxidizing Flame)

RATIO – 4:1

TIP STYLE / TIP SIZE	TIP STOCK NO.	TORCH INLET PRESSURES (PSIG)*										PRI-MARY CONE LGTH. (IN.)	QTY. OF 115 LB. CYL. REQ'D FOR CONT. OPER. **	EFFICIENT FUEL FLOW RATE (CFH)	MIN. HOSE SIZE I. D. (IN.) (25-FT. LG.)	AMT. OF HOLES / DRILL NO.
		STYLE 800 TORCH & MIXER STOCK NO.						STYLE 750 TORCH & MIXER STOCK NO. 810-0781		STYLE 400 TORCH & MIXER STOCK NO. 810-9152						
		811-0899		811-0891		811-0881 811-0890										
		Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy	Fuel	Oxy					
759/7	810-0977	8	11	9	13	10	17	10	13	13	30	9/16	1	20	3/16	7 – 67
759/8	810-0978	9	12	10	14	10	20	11	22	20	40	9/16	1	25	1/4	7 – 63
759/9	810-0979	9	19	10	15	13	34	12	38	–	–	9/16	1	40	1/4	7 – 56
759/10	810-0980	10	21	11	17	20	45	17	49	–	–	9/16	2	50	5/16	7 – 55
742/10	810-0890	–	–	–	–	–	–	20	45	–	–	9/16	2	50	5/16	7 – 55
756/10	811-1910	10	21	–	–	–	–	–	–	–	–	9/16	2	50	5/16	7 – 55
756/12	811-1912	8	25	–	–	–	–	–	–	–	–	9/16	2	75	5/16	12 – 56
756/13	811-1913	9	38	–	–	–	–	–	–	–	–	9/16	3	115	3/8	12 – 54
756/14	811-1914	9	53	–	–	–	–	–	–	–	–	9/16	4	150	3/8	19 – 55
842/12	811-1690	11	23	–	–	–	–	–	–	–	–	9/16	2	75	5/16	12 – 56
757/12	811-2032	8	25	–	–	–	–	–	–	–	–	9/16	2	75	5/16	12 – 56
757/13	811-2033	9	38	–	–	–	–	–	–	–	–	9/16	3	115	3/8	12 – 54
757/14	811-2034	9	53	–	–	–	–	–	–	–	–	9/16	4	150	3/8	19 – 55
757/16	811-2036	13	79	–	–	–	–	–	–	–	–	9/16	6	210	3/8	27 – 54
757/17	811-2037	16	105	–	–	–	–	–	–	–	–	9/16	8	260	3/8	27 – 53
757/18	811-2038	23	122	–	–	–	–	–	–	–	–	9/16	12	380	3/8	37 – 1/16

*Torch inlet pressures given only as a guide to set regulators—with torch valves wide open; and to check restrictions in fuel or oxygen supply systems. Oxygen/fuel ratio is set to flame appearance—when primary cones of length listed above are the shortest obtainable as ratio is varied (oxidizing flame).

**Use cylinders with manifold.

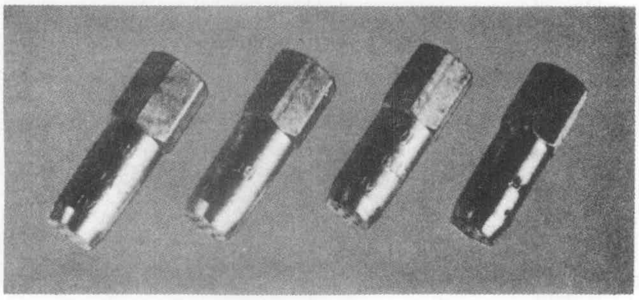
UNIVERSAL MULTI-FLAME HEATING TIPS

Light to Medium Heating
For Style 800, 750 and 400 Torches

Universal Heating Tips operate equally well on all major fuels Acetylene, MAPP Gas, propane and natural gas. Made out of solid copper or copper parts welded together silver brazed joints or mechanical bounding are eliminated. Supported with excellent operating data and recommendation on gas pressures and flows, the users get optimum efficiency.

These heating tips are particularly useful in light range heating and brazing operations. Heat is efficiently concentrated and distributed by seven flames. Tips operate effectively with all fuel gases.

Sizes 5-10 are used with Airco Style 750 or 800 torch with single tube extensions 811-1411 or 811-1412 or dual tube extension 810-0829. Sizes 5, 7, and 8 may be used with Airco Style 400 torch with extension 810-0828.



STYLE 759 MULTI-FLAME HEATING TIP – SEPARABLE TYPE

				Efficient Operating Conditions			
		Flame Pattern		Fuel Gas Flow C.F.H.			
Stock No.	Tip Size	Orifice No.	Drill No.	Acetylene	MAPP® Gas	Propane	Natural Gas
810-0975	5	7	#71	30	12 or 14	10	10
810-0977	7	7	#67	50	20 or 25	15	15
810-0978	8	7	#63	70	25 or 35	25	30
810-0979	9	7	#56	110	40 or 55	40	60
810-0980	10	7	#55	140	50 or 70	50	80
For operating data refer to ADI # →				1717	1718 1719	1720	1721 1722

Check Valves prevent the reverse flow of mixed gases.

UNIVERSAL MULTI-FLAME HEATING TIPS MEDIUM TO HEAVY HEATING FOR STYLE 800 TORCH

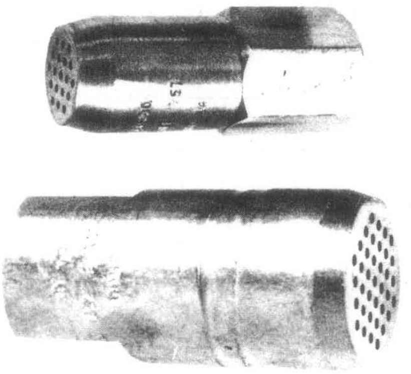
Style 756 Universal Single Tube Multi-Flame Heating Tips

These tips are designed for bronze brazing heavy sections, flame heating, flame hardening and heavy welding. They effectively provide a source of concentrated heat which permits fast, efficient operations.

Style 756 is used with Airco Style 800 torch and positive pressure mixer 811-0899. For low pressure N.G., injector 811-1422 and adapter 811-0388 are used for sizes 10, 12, and 13 and injector 811-1423 is used directly with Size 14 tip.

				Efficient Operating Conditions			
		Flame Pattern		Fuel Gas Flow C.F.H.			
Stock No.	Tip Size	No. Orifice	No. Drill	Acetylene	MAPP® Gas	Propane	Natural Gas
811-1910	10	7	#55	150	50-70	50	80
811-1912	12	12	#56	175	75-100	70	110-140
811-1913	13	13	#54	230	115-150	110	135-210
811-1914	14	19	#55	275	150-200	150	150-280
For operating Data refer to ADI # →				1717	1718 1719	1720	1721 1722

Style 757 Universal Multi-Flame Heating Tip — Separable Type



These tips are useful for medium to very heavy bronze brazing, flame heating, hardening, and heavy welding. Flame stability and heating efficiency characterize this style of tip. Style 757 tips are used with Airco Style 800 torch. 18", 24" or 42" extension tubes (Stock No.s 811-0853, 0991 and 0992 respectively) are available. Adapter 811-1410 must be used with this tip style.

				Efficient Operating Conditions			
		Flame Pattern		Fuel Gas Flow C.F.H.			
Stock No.	Tip Size	No. Orifice	No. Drill	Acetylene	MAPP® Gas	Propane	Natural Gas
811-2032	12	12	#56	175	75-100	70	110-140
811-2033	13	12	#54	230	115-150	110	135-210
811-2034	14	19	#55	275	150-200	150	150-280
811-2036	16	27	#54		210-300	250	170-475
811-2037	17	27	#53		260-370	300	575
811-2038	18	37	1/16 dia		380-550	350	675
For operating data refer to ADI # →				1717	1718 1719	1720	1721 1722

GAS MIXERS FOR UNIVERSAL HEATING TIPS
NEW EXTERIOR DESIGN

MIXER STOCK NUMBER	MIXER INTERNAL THREAD	MIXER ADAPTER	EXTENSION	EXTENSION ADAPTER	STYLE 759 SINGLE SIZE	STYLE 759 DUAL SIZE	STYLE 756 SIZE	STYLE 757 SIZE
811-0881	7/16-20	811-0493	811-1411	–	5 to 10			
811-0890	3/8-20	not needed	811-1412	–				
811-0891	3/8-20	not needed	810-0829	–		5 to 8		
811-0899 High Capacity "Jet Mixer"	1/2-20	811-0494	811-1411 811-1412	– –	5 to 10			
			810-0829	–		5 to 10		
		not needed	811-0853-18" 811-0991-24" 811-0992-42"	811-1410				12 to 18
			not needed	–			10 to 14	
811-1421* L.P. 811-1422 L.P.	3/8-20	not needed	811-1411 811-1412	– –	5 to 8* 9 & 10			
			810-0829	–		5*/8 & 9		
		811-0388	811-0853-18" 811-0991-24" 811-0992-42"	811-1410				12 & 13
			not needed	–			10 to 13	
811-1423 L.P.	1/2-20	811-0494	810-0829	–		10		
		not needed	811-0853	811-1410			14	14 & 16

FOR 750 SERIES TORCH								
810-0781	3/8-20	not needed	811-1411 811-1412	–	5 to 10			
			810-0829	–		5 to 8		
L.P. 810-0713* 810-0714	3/8-20	not needed	811-1411 811-1412	–	5 to 8* 9 & 10			
			810-0829	–		5*/7 & 8		

FOR 300 & 400 SERIES TORCHES								
								STYLE 754
810-9152	1/4-32	not needed	810-0828	–	5 to 8			
			not needed	–				8

No internal change on all the mixers listed above.

* Mixers 811-1421 and 810-0713 are of the injector design for low-fuel pressures.

They provide limited gas flows and are to be used with Style 759, Size 5 to 8 only as indicated in the table by means of an asterisk.

UNIVERSAL MULTI-FLAME HEATING TIPS
STYLE 800 WELDING TORCH

Style 842 Multi-Flame Heating-Tip Mixer Assembly

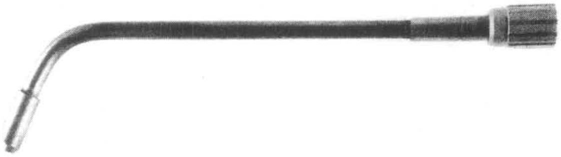
Assembly includes a 7-hole multi-flame heating tip, matched mixer, neoprene gas sealing rings, and tip nut. It has the high efficiency and heating speed required in many silver soldering, brazing, heating, and flame-hardening applications, and is excellent for welding sections.

STOCK NO.	TIP SIZE	FUEL GAS	PRESSURE RANGE P.S.I.	FLOW RANGE C.F.H.
811-1690	10	See ADI's 1717 to 1722		

STYLES 700 AND 750 WELDING TORCHES

Style 742 Multi-Flame Heating-Tip Mixer Assembly

Assembly includes an 11-hole multi-flame heating tip, matched mixer, neoprene gas sealing rings, and tip nut. It has the high efficiency and heating speed required in many silver soldering, brazing, heating, and flame-hardening applications, and is excellent for welding sections.



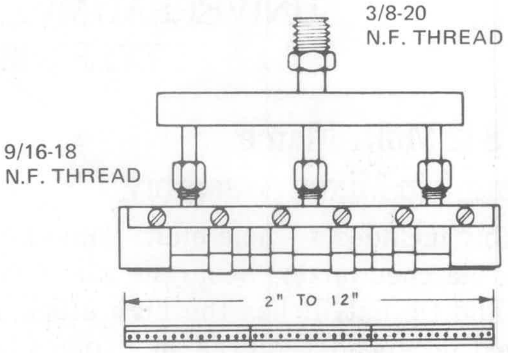
STOCK NO.	TIP SIZE	FUEL GAS	PRESSURE RANGE P.S.I.	FLOW RANGE C.F.H.
810-0890	10	See ADI's 1717 to 1722		

Style 754 Heating Tip — Separable

Use mixer 810-9152. This heating tip is particularly useful in light-range heating and brazing.

STOCK NO.	TIP SIZE	LENGTH
810-0968	8	4½″

Style 120 Flat Descaling Tip Assemblies



These tips consist of flat brass sections two inches long manifolded together to give the desired width. In each two-inch section there are 14 inline #68 drilled gas parts. The wear surfaces on the sides of the tips are protected by removable steel plates formed to fit. Sizes, which range from 2 to 8, indicate the width in inches.

For descaling, flame hardening and automatic silver brazing operations.

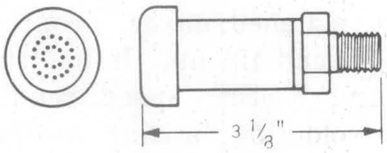
STYLE 120

STOCK NO.	TIP SIZE	FUEL GAS	FLAME PATTERN	PRESSURE RANGE P.S.I.*	FUEL GAS FLOW RANGE C.F.H.**
811-1202	2	Acety.	Multi-Flame	3-10	30-60
811-1204	4	Acety.	Multi-Flame	3-10	60-120
811-1206	6	Acety.	Multi-Flame	3-10	85-180
811-1208	8	Acety.	Multi-Flame	3½-11	110-220
811-1210	10	Acety.	Multi-Flame	4-10	140-270
811-1212	12	Acety.	Multi-Flame	4-9	155-270

* Torch valves wide open.

** Where flows exceed 50 CFH, two or more manifolded acetylene cylinders should be used.

Style 738 Round Descaling Tip—Separable Type



This tip is generally used for flame descaling and preheating in welding. It is equipped with a wear ring. Can be used for flame cleaning and dehydrating.

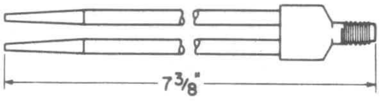
STYLE 738

STOCK NO.	TIP SIZE	FUEL GAS	MULTI-FLAME PATTERN NO HOLES	PRESSURE RANGE P.S.I.*	FUEL GAS FLOW RANGE C.F.H.**
811-1500	0	Acety.	21#66	3-7	40-110
811-1501	1	Acety.	25#62	3-11	75-215
811-1502	2	Acety.	25#58	3-11	80-220

ACETYLENE BRAZING AND HEATING TIPS
FOR SPECIAL APPLICATIONS
STYLES 700 AND 750 WELDING TORCHES

Style 728 Bulbous-Flame Flexible Two-Tube Tips

These tip tubes, fully annealed, can be individually bent to suit the job. They are excellent in silver brazing and light heating work. Thread size is 3/8-20 N.S. Male.

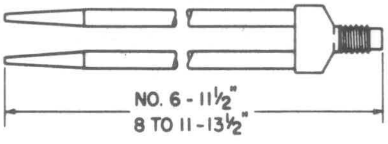


STOCK NO.	TIP SIZE	FUEL GAS	PRESSURE RANGE P.S.I.	FLOW STOCK CFH
810-0462	2	Acety.	2-7	3-11
810-0463	3	Acety.	2-10	6.5-20.5
810-0464	4	Acety.	3-12	14-34
810-0465	5	Acety.	3-12	21-53.5

STYLE 800 WELDING TORCH TIP SPECIFICATIONS

Style 731 Two-Flame Dual Tube Bulbous Type Tips

These tips have two annealed flame tubes that can be bent to suit job for best heat distribution. They are ideal for silver brazing, flame hardening, and heating applications.

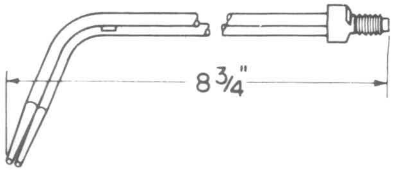


STOCK NO.	TIP SIZE	FUEL GAS	FLAME PATTERN	PRESSURE RANGE P.S.I.	FUEL GAS FLOW RANGE
811-1338	8	Acety.	Bulbous	5-12	45-105
811-1340	10	Acety.	Bulbous	3-12	85-205
811-1341	11	Acety.	Bulbous	3-11	90-230

STYLE 733 DUAL TUBE, TWO-FLAME

Style	Stock No.	PSI	SCH
733	811-1380	3-11	100-210

These Tips are ideal for flame hardening of light sections, hard facing and brazing.



ACETYLENE DESCALING BRAZING TIPS
(SPECIAL APPLICATIONS)
GAS MIXERS — EXTENSIONS — ADAPTERS

MIXER STOCK NUMBER	MIXER INTERNAL THREAD	FOR TIP SIZE	MIXER ADAPTER	EXTENSION	EXTENSION ADAPTER	TIP STYLE	TIP STOCK NO.	TIP SIZE
FOR STYLES 700 AND 750 TORCHES								
810-0780	3/8-20	2-5	–	811-0160	–	728	810-0462	#2
810-0781	3/8-20						810-0463	#3
							810-0464	#4
							810-0465	#6
FOR STYLE 800 TORCH								
811-0881	7/16-20	6	–	811-0893	–	731 †	811-1336	#6
811-0899	1/2-20	6	811-0389	811-0893	–		811-1338	#8
		8, 10, 11	–	811-0850	–		811-1340	#10
811-0913	1/2-20	8, 10, 11	–	811-0850	–		811-1341	#11
811-1415**	1/2-20	8, 10, 11	–	811-0850	–			
811-0899	1/2-20	10	–	811-0850	–	733 †	811-1380	#10
811-0913	1/2-20							
811-1415**	1/2-20							
811-0899	1/2-20	0, 1, 2	–	811-0853 811-0991 811-0992	–	738 †	811-1500 811-1501 811-1502	#0 #1 #2
811-0913	1/2-20							
811-1415**	1/2-20							
811-0881	7/16-20	2	811-0404	–	–	120 †	811-1202	#2
811-0899	1/2-20	2	–	811-0850	811-0869		811-1204	#4
		4, 6, 8	–	811-0996 811-0997	–			
811-0913	1/2-20	2	–	811-0850	811-0869		811-1206	#6
		4, 6, 8	–	811-0996 811-0997	–		811-1208	#8

* Optional

** Semi-Injector Type

† For the most efficient operation of these tips, consuming more than 60 CFH of acetylene, it is necessary to manifold cylinders.

5. THEORY OF OXY-FUEL CUTTING

Principle of the Process

The oxygen cutting process involves the combination of a chemical reaction and the mechanical erosion of the molten metal. In order to start the chemical reaction, the metal must be rought to the kindling temperature at the upper edge of the cut, ahead of the cutting oxygen stream. This kindling temperature which is approximately 1400°F to 1600°F is produced by the preheat flames. Once this kindling temperature is reached, the cutting oxygen jet is introduced in the center of the concentric formation of the preheat flames and creates a rapid oxidation of the material down through the depth of the plate. It also generates sufficient exothiermic heat, created by the reaction of the molten steel and oxygen, to provide for continuous preheating of the metal ahead of the cut.

Theoretically, one cubic foot of oxygen oxidizes 0.217 lb. or 0.761 cu. inch of pure iron.

In actual practice, the iron removed from the kerf is not entirely consumed by the oxygen. Due to the erroding effect of the cutting oxygen jet, about 30 to 40 percent of the material is washed out as unconsumed metallic powder. It is, therefore, possible to obtain satisfactory cuts with a cutting oxygen consumption of somewhat less than one cubic foot of oxygen per cubic inch of material removed from the kerf. Assuming that 65 percent of the iron is oxidized or consumed during a cut, 540 B.T.U. are generated per cubic inch of metal removed. This is two or three times the heat supplied by the preheating flames in conventional cutting.

Preheat Function

Preheat flames are needed in flame cutting for several reasons. The first is to heat the plate to kindling temperature to initiate the cutting process. The second is to lift off mill scale and occasionally an oxide crust from the top surface of the plate as the cut progresses across the work. The third reason is that the preheat flames maintain a small bright spot of molten metal, at kindling temperature, ahead of the cutting oxygen stream, to insure the continuous ignition of the ferrous metal as the oxygen stream enters the plate maintaining a uniform reaction; producing a smooth cut. The fourth reason is that the preheat flames serve to protect the oxygen stream from dilution by the surrounding air. Generally, it is also agreed that the preheat flames serve to maintain the slag in a fluid condition, to run down the kerf.

Cutting Quality

To obtain a prime quality cut for a given thickness of material, there is a narrow range of cutting speed which always is the same regardless of the fuel used. It is not because you have a very hot flame that you will get better quality at greater speeds. Hot fuel, such as MAPP Gas, permits substantially higher cutting speeds. The quality of the cut will lessen as cutting speed increases. It is not the nature of the fuel which gives the better quality. It is the formation of the cutting oxygen jet combined with the proper cutting speed which yields a prime quality cut. For quality cutting, the use of one fuel has no more influence on the cutting speed than any other fuel. What really has the most influence on cutting speed is the cutting oxygen jet. The conception and level of a quality cut is often determined by the end use of the cut part.

It is well known that for identical conditions of cutting, it requires the same amount of cutting oxygen to perform the cut, regardless of the fuel gas used for the preheating.

The cutting speed for a given thickness of material is governed primarily by the rate of slag removal from the kerf. By using a larger oxygen jet we expose a wider cutting oxygen front to the material being cut. This permits a faster progression of the cut across the work plate. More B.T.U. are generated by the wider exothermic heat reaction zone.

This is based on the assumption that the work plate surface is in reasonable condition and the preheating is sufficient to lift the surface scale and maintain the upper edge of the cut at kindling temperature.

If the main part of the oxy-fuel cutting performed in a fabrication shop is done on clean plates with conventional cutting either in straight line or shape cut with a cutting machine, natural gas or propane can do well.

If the main part of the burning done in a fabrication shop involves edge preparation or beveling such as in heavy tank fabrication, MAPP gas or acetylene should be considered because the concentrated and higher temperature of the preheat flame gives a better retention of the cut in beveling application which permits higher beveling speeds.

In reclamation yards or scrap yards, natural gas would be the least desirable. Generally steel cut for scrap is covered with rust, dirt or paint which must be lifted off effectively as the cut progresses. In this type of work, the higher temperature of the other fuels, particularly MAPP gas and acetylene, is important.

An important controlling factor influencing oxygen cutting speed is the degree of quality of cut desired.

A cut of high quality must exhibit the following four characteristics.

1. The face of the cut is flat and smooth.
2. There is good perpendicularity of the face cut with the plate.
3. The top edge is not rolled or melted by the preheat flames.
4. The lower edge is free of slag.

Achievement of this high degree of quality was a required standard when oxy-flame data was established years ago.

The presence of curved drag lines is not considered to be a defect in straight line cutting. In shape cutting, the degree of drag must be maintained as close to zero as possible in order to avoid undercutting of the work piece where sharp changes in direction occur.

The perpendicularity or angularity of the cut face is important. Substantial deviations from perpendicularity or the desired angle are generally not acceptable.

Good shape cutting machine operators check the perpendicularity of their torches with reference to the plate to be cut and not with the machine. When the face cut angle is the result of a kerf that is wider at the bottom, it is sometimes referred to as a negative angle. This is due to oversize tip and excessive oxygen pressure and volume which creates a divergence of the cutting jet causing the kerf to be wider at the bottom.

The top edge of the cut should be reasonably sharp. This is a matter of preheat flame intensity. However, it is not unusual to encounter conditions in which it is not possible to obtain a consistently sharp edge, due to very heavy mill scale on the plate, or in cutting of heavy plate.

In normal operations, work pieces are frequently found with slag adhering to the bottom of the cut face. If this slag detaches itself from the work pieces in the normal following operations, it should not be called a "slag condition". A slag condition is one in which it is necessary to resort to hand chipping, grinding, or the use of a pneumatic chisel to remove the adhering slag.

If the four requirements just stated are met, good quality cutting is obtained. However, in many cases, this high level of quality is not required. A slightly lower quality is very often acceptable in the steel fabrication industry where a large part of cut surface is covered by weld metal or where the cut is hidden inside a machine frame or covered with several coats of paint, or machined after cutting.

It is the reason why at Airco we have two types of cutting guides for our latest tips "Master Tips". In the conventional two-piece tip line we have Style 361 for high speed high quality cut and Style 363 for high production cutting. The main difference between these style of tips is in the size of the cutting oxygen orifices.

TYPICAL COMPARATIVE CUTTING OXYGEN CONSUMPTION PER 100 FEET OF CUT

	STYLE 361 HIGH QUALITY				STYLE 363 HIGH PRODUCTION			
MTL. TH.	HIGH CFH	SPEED CFM	CUTTING TIME	TOTAL O_2 CONS.	CFH	CFM	CUTTING TIME	TOTAL O_2 CONS.
1/2	75	1.25	66	83	105	1.75	46	80
3/4	95	1.59	70	111	120	2.00	50	100
1	115	1.91	75	143	145	2.41	55	120
1-1/4	137	2.28	80	183	168	2.80	60	168
1-1/2	150	2.50	92	230	210	3.50	70	245
2	180	3.00	100	300	240	4.00	75	300
2-1/2	220	3.66	109	399	300	5.00	80	400
3	270	4.50	120	540	360	6.00	92	552
4	325	5.42	132	704	450	7.50	109	817

The above table shows the comparative consumption of cutting oxygen for various thicknesses with the two cutting speed ranges, high speed high quality and high production.

It can be seen that in spite of the increased flow rate, the overall consumption remains almost the same. Therefore, the labor saving for the actual cutting time is a net saving.

In conclusion, if the maximum degree of cut quality, which is characteristic of the cutting speed range used presently in the industry, is not required, higher cutting speeds yielding reasonably good quality cutting can be reached by expending more cutting oxygen on an hourly rate basis. For most cutting conditions, the amount of oxygen required for a given job at high production cutting speed is equal to that required at conventional cutting speeds.

FLAME CUTTING—PIERCING TECHNIQUE

Flame cutting of parts often requires piercing of the plate to start the cut. As the plate thickness increases, piercing gets more difficult; and when the plates reach a thickness of 3 or 4 inches, piercing starts can be quiet and successful, or they can be a nightmare of spatter resulting in damaged tips, or tips clogged with slag which must be removed to obtain a quality cut. The techniques for getting quiet, successful pierces with minimal tip cleaning are outlined as follows:

1. Pierce on high preheat

(Hold preheat over-ride switch on until pierce is completed)
Smooth, successful starts can be obtained on low preheat if careful control of the cutting oxygen ease-on is exercised. However, the ease-on is much less critical and cutting oxygen pressure can be brought up quickly if the high preheat is left on until the pierce through the plate is completed. Preheat can then be reduced to normal low for cutting. The use of high preheat is very effective in minimizing spatter, and will usually eliminate the need to clean tips after a pierce before starting the cut.

2. Pierce with the face of the tip 1-1/4 - 1-1/2 inch above plate

The closer the tip is to the work, the greater the probability the tip will become clogged with spatter and require cleaning before a quality cut can be produced. It may be necessary to get the tip close to the plate to get the spot hot enough to start the pierce. However, after the spot is hot enough, the tip should be raised to a height of 1-1/4 - 1-1/2 inches to get it out of the spatter region before the pierce is made. When using MAPP Gas, rectangular spline tips should always be used because they are less susceptable to flashback due to spatter and because they will heat the spot from a greater height off the plate.

3. Use a travel speed of zero to three inches/minute during the pierce

Piercing at travel speed below three inches/ minute is very successful, and produces a puddle of slag behind the tip as it moves.

Too high a travel speed during a pierce will produce a high level of spatter and result in failure to pierce and/or clogged or damaged tips, even at 1-1/2 inch tip height and high preheat level.

A standing pierce, or pierce at zero speed using the techniques described above should be quiet and successful, with little or no spatter, and result in a clean tip and a hot ring of slag around the piercing hole. As soon as the pierce is completed, while the slag is still hot, the cut across this ring of slag can be made at normal cutting speed with the preheat level still high. The 1-1/4 to 1-1/2 inch tip height will easily clear the ring of slag. If the ring of slag is allowed to cool after the pierce, it must be removed before an edge start can be made at the pierced hole. Removal of the ring is much easier if the pierce is made at high preheat.

PLATE EDGE PREPARATION WITH AIRCO TRIPLE BEVEL HEAD

I. Torch Arrangement And Distance Between Tips

II. Setting Gas Pressures

III. Adjusting Preheat Flame

IV. Tip to Work Separation

V. Adjusting The Torch For Bevel Size

The following is a description of the different settings to obtain three basic edges:

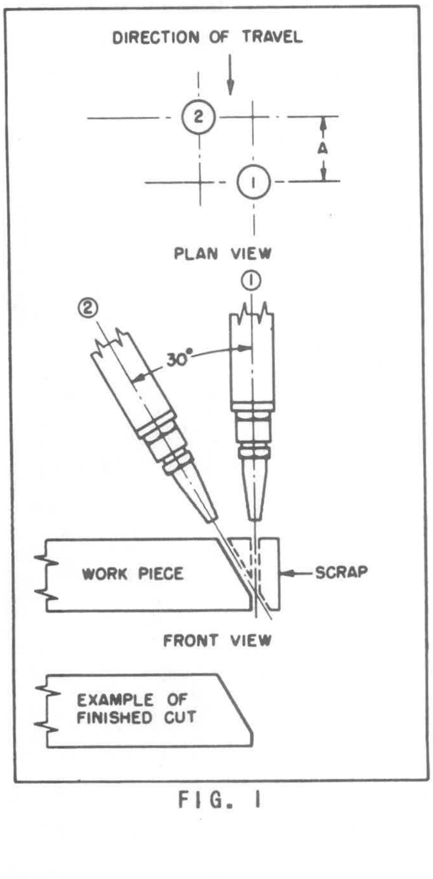


FIG. 1

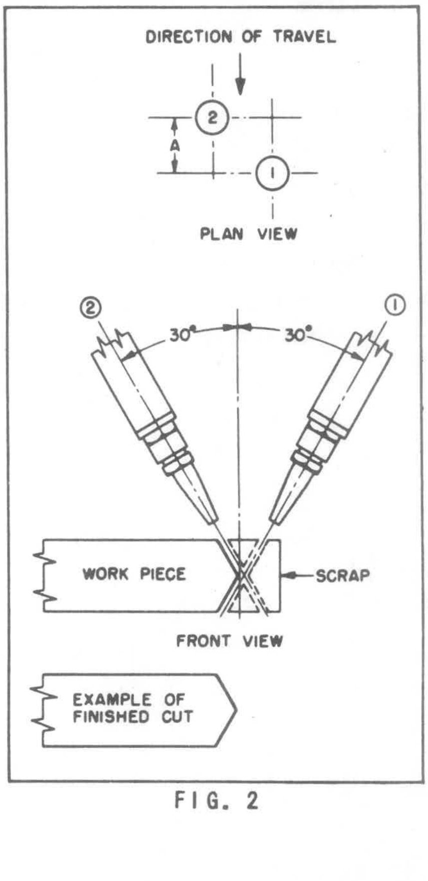


FIG. 2

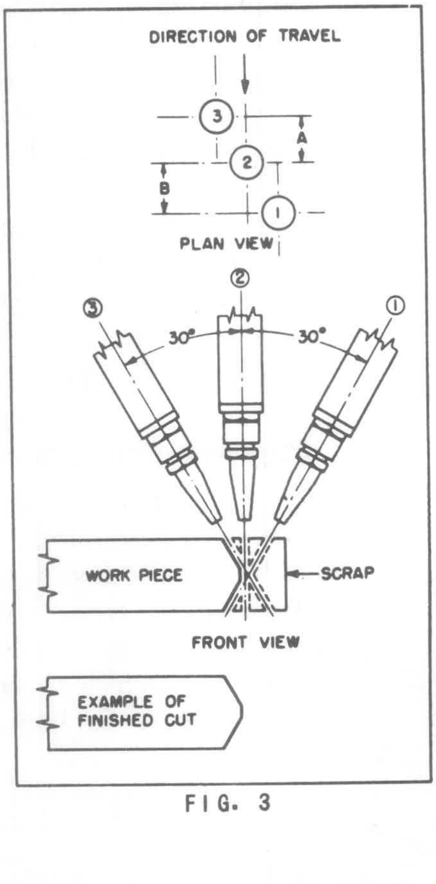


FIG. 3

Figure 1—The plan view shows a two-torch arrangement to make simultaneously a single bevel cut with a land at the bottom. Torches are so positioned that No. 1 torch leads, producing the land at the bottom, while No. 2 follows, producing the top or open bevel.

Figure 2—This figure shows a two-torch arrangement to make simultaneously a double cut at a 30-degree angle. Torches are so positioned that No. 1 torch leads, producing the bottom or closed bevel, while torch No. 2 follows, producing the top or open bevel.

Figure 3—The plan view for this figure shows a three-torch arrangement to make simultaneously a double bevel cut at a 30 degree angle with a land at the center. Torches are so positioned that No. 1 torch leads, producing the bottom or closed bevel, torch No. 2 follows, producing the land, while torch No. 3 comes last, producing the top or open bevel.

In each case, torch position variables A and B are governed by the plate thickness, tip size, speed of cutting, etc. Tips lead one another as much as practical without interrupting the cutting action of the oxygen stream. When dimensions A and B are too great, however, the cutting action does not continue beyond the kerf of the leading torch, causing the oxygen stream to be deflected into this kerf, resulting in a gouging action and producing a rough surface.

Dimensions A and B should be between 5/16 and 1/2 inch for plate thicknesses up to approximately 1-1/2 inch.

6. AIRCO CUTTING TIPS

The Airco cutting tip line covers every aspect of the oxy-fuel cutting process.

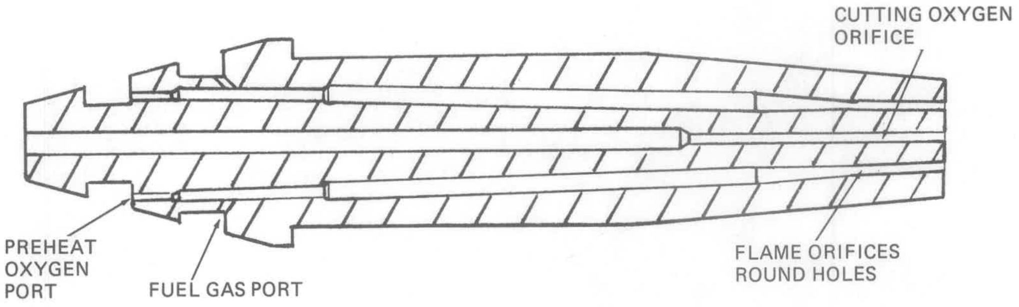
Types of Tips

Cutting tips can be categorized in two ways. 1). By fuels and construction, or 2). by type of operation, general purpose or high speed operation.

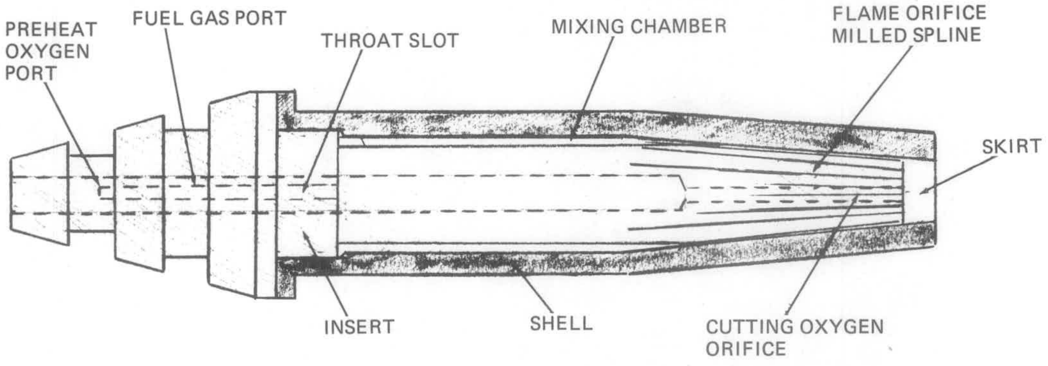
1). When looking at them from the fuel or construction standpoint, we have the solid copper tips for acetylene and MAPP Gas and the two piece tips for MAPP Gas, natural gas and other liquid petroleum gases. (See Fig. G-9).

2). If we look at them from the type of operation viewpoint, we have the general purpose tips, which can be either of the solid copper or two piece type (See Fig. G-10). Their similarity is that their cutting oxygen port is referred to as "straight bore". This means that the cutting oxygen orifice comes down straight to the tip end. The average cutting oxygen pressure used is 50 p.s.i. These tips are always used with hand operation and often on small cutting machines.

The other type, which also can be either of the solid copper or two piece type, is the high speed or divergent-bore type (Fig. G-10) This means that the cutting oxygen orifice is smaller for a given material thickness but the cutting oxygen pressure used averages 100 p.s.i. The end of the oxygen orifice is tapered out which makes the cutting oxygen jet diverge slightly within the port before its exit in free air. This design permits cutting at speeds 30% higher and yields a noticeably smoother face cut.



ONE-PIECE TIP STRAIGHT BORE



TWO-PIECE TIP STRAIGHT BORE

Figure G-9

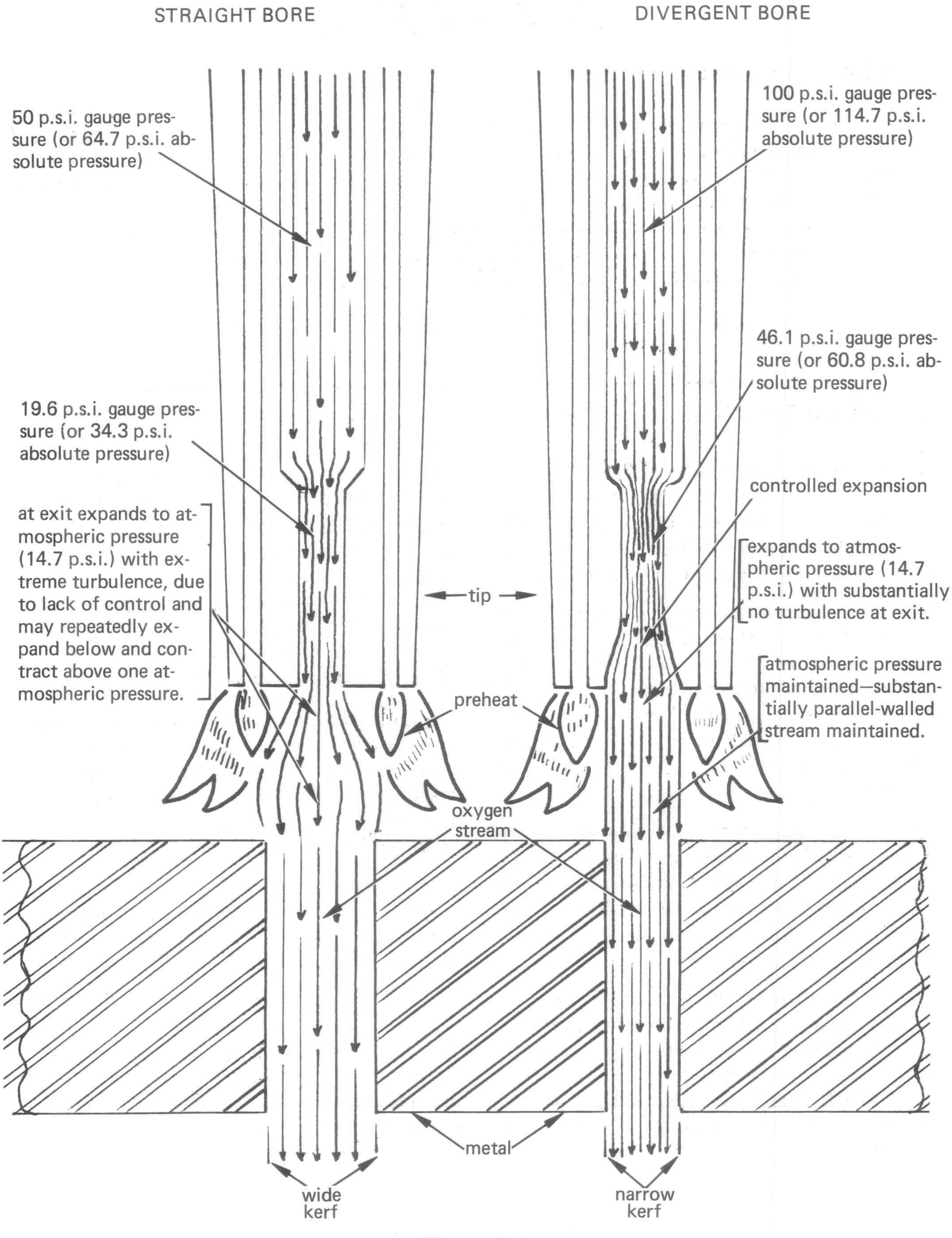

STRAIGHT BORE
DIVERGENT BORE
50 p.s.i. gauge pressure (or 64.7 p.s.i. absolute pressure)
100 p.s.i. gauge pressure (or 114.7 p.s.i. absolute pressure)
46.1 p.s.i. gauge pressure (or 60.8 p.s.i. absolute pressure)
19.6 p.s.i. gauge pressure (or 34.3 p.s.i. absolute pressure)
controlled expansion
at exit expands to atmospheric pressure (14.7 p.s.i.) with extreme turbulence, due to lack of control and may repeatedly expand below and contract above one atmospheric pressure.
expands to atmospheric pressure (14.7 p.s.i.) with substantially no turbulence at exit.
tip
atmospheric pressure maintained—substantially parallel-walled stream maintained.
preheat
oxygen stream
metal
wide kerf
narrow kerf

Figure G-10

OXY-FUEL CUTTING TIPS
PREHEAT PATTERNS

One piece tips Acetylene

Acetylene tips come with various numbers and sizes of preheat orifices. Airco acetylene cutting tips come in five styles which give four different intensity of preheat to be used in function of the work to be done — clean plate, shape cut, high speed or scaly and dirty work surface. To give an idea of the difference in consumption, the following table shows the preheat gas flows for a size 1 to cut 1/2 in. material with the five styles.

PREHEAT	TIP STYLE	PREHEAT HOLE NUMBER	PREHEAT HOLE SIZE	PREHEAT HOLE DIA.	FLOW CFH OXY.	FLOW CFH ACETYL.
Very Light	124	4	68	.032	12	11
Light	138	6	71	.031	14	13
Medium	45	6	67	.026	20	18
Medium	144	4	61	.039	24	22
Heavy	164	6	62	.038	28	25

Two Piece Tips Natural Gas-Propane

The earlier two piece tips for natural gas and propane use had preheat patterns consisting of deep 36° Vee spline or groove. The flame flared out dispersing the heat away from the center of the spot being heated on the plate.

The next styles of tips had a drastically different preheat pattern. It had 19 thin rectangular splines giving a tight flame formation with a good heat transfer into the plate. Its weakness was in the flame stability. Its flow range was limited and the flame would blow away as soon as this low limit had been reached.

The next development consisting of twelve shallow 36° Vee splines, gives an excellent flame stability and great preheat gas flows can be pushed through it. However, the heat transfer efficiency is not as good when compared to its predecessor.

The latest styles have a preheat pattern which is a compromise between the thin rectangular and the 36° Vee splines. It consists of 14 thin 22° Vee splines. The result is a flame which gives nearly the good heat transfer efficiency of thin rectangular splines and the good flame stability at greater flow of 36° Vee splines. It has been generally well accepted in the industry for use with natural gas and propane. This preheat pattern is also used with MAPP Gas. For this fuel the tip shells used with natural gas and propane are replaced with shorter shells to prevent overheating. However, the most popular two piece MAPP Gas tips have thin rectangular splines. The burning characteristics of MAPP Gas lends itself well to this pattern.

With natural gas and propane the preheat patterns mentioned above are adequate up to approximately 6 inches. Once the material thickness is over 6 inches, the starting time is immaterial and the length of the secondary flame becomes very important.

It must extend as far as the bottom of the planned cut. Once the cutting oxygen is turned on, the length of the secondary flame shortens. It still should extend two thirds of the way down in order to obtain a good quality cut.

For this reason most cutting tips designed to cut material over 6 inches thick with natural gas and propane have deep 36° Vee groove similar to the early two piece tips.

TYPES OF CUTTING TIPS VERSUS MATERIAL THICKNESS

The range of material thickness cut by hand is limited. It is much different with cutting machine operations where the largest tonnage of material is cut.

Airco machine cutting torches Style 2600 or 4700 are designed to cut from 1/8 inch up to 14 or 16 inches thick. In order to efficiently cut this wide range of thickness, tips of the same type of oxygen bore or preheat pattern are not usually used.

The following is what is usually done — from 1/8 up to 1/4 the use of a high speed divergent bore is not especially recommended if using natural gas or propane — general purpose tips are just as good. From 3/8 up to 5 inches high speed divergent bore give the best results. Beyond that point there are no differences in cutting speeds between types of tips. As a result, from 5 to 7 inches general purpose straight bore tips are used. From 8 inches and up the tips must have large splines for long secondary flames.

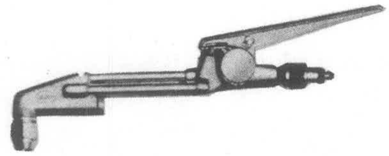
EVOLUTION OF THE TYPE OF PREHEAT PATTERN
USED WITH NATURAL GAS & PROPANE

APPROX. YEAR	STYLES	PREHEAT PATTERNS	FLAME CHARACTERISTICS
1942	219-229 46-46H	36° Vee Large Splines	Flame flaring out Inefficient heat Transfer
1955	250-260 350-360	Thin rectangular splines	High heat transfer efficiency. Poor flame stability
1960	251-261 351-361	12 and 16 36° Vee Medium splines	High flame stability Limited heat transfer
1965	263 363	14 and 18 22° Vee Small splines	Good flame stability Good heat transfer

ACETYLENE HAND CUTTING TIPS

Airco's two styles of acetylene hand cutting tips with the current cutting attachment which they fit are shown below. The Style 145 tip fits the following discontinued Airco cutting attachments: Style 1700, 1800, 2400, 2790, 7700, 7800, 9800, and 9900.

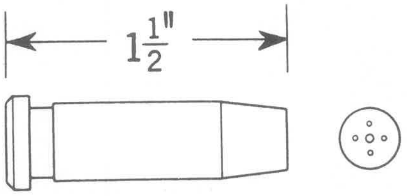
DISCONTINUED
STYLE 2700 CUTTING ATTACHMENT



STYLE 1490 CUTTING ATTACHMENT

DISCONTINUED
STYLE 2400 CUTTING ATTACHMENT

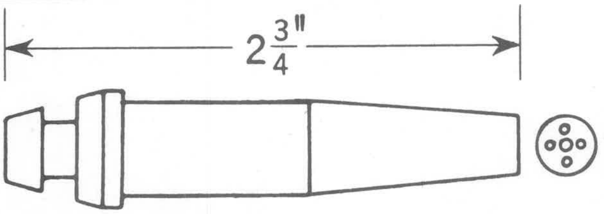
This acetylene tip has a flat seat. It is used for hand cutting on material up to 1" (2.54 cm.) thick with the Style 1490 cutting attachment and Style 300 or 400 torches. It is also used with Style 2400 cutting attachment with the Style 700* or 750 torch handle to cut material up to 3" (7.6 cm.) thick.



STYLE 112 GENERAL-PURPOSE CUTTING TIP

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
1/8" (.3 cm.)	00	4	854-1299
1/4" (.6 cm.)	0	4	854-1200
1" (2.54 cm.)	1	4	854-1201
2" (5.1 cm.)	2	4	854-1202
3" (7.6 cm.)	3	4	854-1203

This acetylene tip has a tapered 2 land seat. It is used for hand cutting on material up to 3" (7.6 cm.) thick with the Style 2790 cutting attachment and Style 700* or 750 torch.



STYLE 145 GENERAL-PURPOSE CUTTING TIP

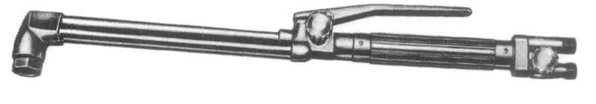
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
1/8" (.3 cm.)	00	4	854-4599
1/4" (.6 cm.)	0	4	854-4500
1/2" (1.3 cm.)	1	4	854-4501
1" (2.5 cm.)	2	4	854-4502
1 1/4" (3.2 cm.)	3	4	854-4503
2" (5.1 cm.)	4	4	854-4504
3" (7.6 cm.)	5	4	854-4505

*700 Torch is Discontinued.

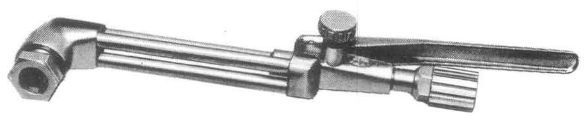
ACETYLENE GENERAL PURPOSE CUTTING TIPS

There are four different styles of general purpose cutting tips for acetylene use. Made of tellurium copper, they are the medium pressure gas tip mixing type. They have a 3/4" (19 mm) diameter three land tapered seat and fit the cutting attachment and cutting torches shown above.

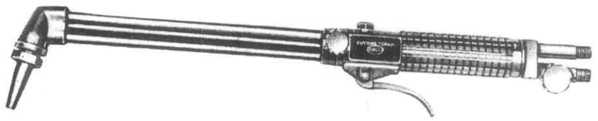
The physical dimensions and appearance of the four styles are the same. The variations between styles are in the number of preheat orifices and their oxygen bores.



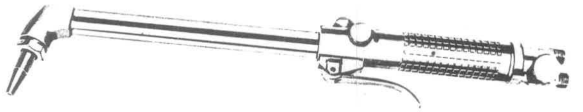
1100 TORCH



STYLE 3790, 4700 & 4800 CUTTING ATTACHMENT



3,000 & 9000 TORCH

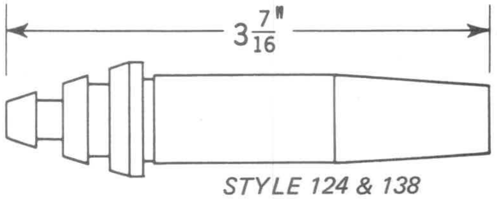


9500 TORCH

Style 124

This light preheat tip has four flames designed to cut clean material. It fits any of the Airco hand torches shown above to cut material up to 8 (20.3 cm.) inches. It also fits the 4700 series machine torch to cut up to 12 (30.5 cm.) inch material.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
1/8" (.3 cm.)	00	4	854-2499
1/4" (.6 cm.)	0	4	854-2400
1/2" (1.3 cm.)	1	4	854-2401
1 (2.5 cm.)	2	4	854-2402
2" (5.1 cm.)	3	4	854-2403
2 1/2" (6.4 cm.)	4	4	854-2404
4" (10.2 cm.)	5	4	854-2405



STYLE 124 & 138
STYLE 144 & 164

CUTTING GUIDE STYLE 124 CUTTING TIP
LIGHT PREHEAT FOR CLEAN SURFACES ON LOW CARBON STEELS

THICKNESS	STYLE 124 TIP	PRESSURES-P.S.I.		SPEED	GAS CONSUMPTIONS					
					CU. FT. PER HR.				CU. FT./LIN. FT. OF CUT	
INCHES	NO.	OXYGEN	ACETY.	IN./MIN.	CUTTING OXYGEN	PREHEAT OXYGEN	TOTAL OXYGEN	PREHEAT ACETY.	OXYGEN	ACETY.
1/8	00	30	3	18-20	25	7	32	6	.355-.320	.067-.060
1/4	0	30	3	16-18	41	10	51	9	.640-.570	.112-.100
3/8	1	30	3	15-17	60	13	73	12	.970-.860	.160-.142
1/2	1	40	3	13-15	76	13	89	12	1.37-1.18	.184-.160
3/4	2	40	3	11-13½	108	15	113	14	2.05-1.68	.255-.207
1	2	50	3	10½-12½	126	15	141	14	2.68-2.25	.267-.224
1¼	3	40	3	10-12	148	18	166	16	3.32-2.78	.320-.268
1½	3	45	3	9-11	162	18	180	16	4.00-3.28	.356-.292
2	3	50	3	7½-9	177	18	195	16	5.20-4.33	.427-.356
2½	4	50	3	7-8	230	19	249	17	7.10-6.20	.485-.425
3	4	65	3	6-7	283	19	302	17	10.0-8.65	.568-.485
4	5	60	4	5-6	337	24	361	22	14.4-12.0	.880-.785
5	6	55	5	4½-5½	394	31	425	28	18.9-15.4	1.24-1.02

Style 138

This light-preheat tip, designed for fine contour cutting of plate, has six preheat flames in a tight circle around the cutting oxygen stream. It fits all the hand torches previously shown. It is well recommended for use in machine cutting with the 4700 series torches.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
⅛″	00	6	854-3899
¼″	0	6	854-3800
½″	1	6	854-3801
1¼″	2	6	854-3802
2″	3	6	854-3803
2½″	4	6	854-3804

CUTTING GUIDE STYLE 138 CUTTING TIP
VERY LIGHT PREHEAT, FOR MACHINE SHAPE CUTTING
LOW CARBON STEELS

THICKNESS INCHES	STYLE 138 TIP NO.	PRESSURES-P.S.I.		SPEED IN./MIN.	GAS CONSUMPTIONS					KERF WIDTH	CLEANING DRILL	
					CUBIC FEET PER HOUR				CU. FT./ LIN. FT. CUT			
		CUTTING OXYGEN	PREHEAT ACETYLENE		CUTTING OXYGEN	PREHEAT OXYGEN	TOTAL OXYGEN	PREHEAT ACETY.	CUTTING OXYGEN		CUTTING	PREHEAT
1/4	0	30	3	20	42	12	54	11	.420	.075	64	76
3/8	1	30	3	19	62	14	76	13	.655	.095	57	73
1/2	1	40	3	17	78	14	92	13	.920	.095	57	73
3/4	2	40	3	15	110	17	127	15	1.47	.110	55	71
1	2	50	3	14	130	17	147	15	1.86	.110	55	71
1¼	2	60	3	13	150	17	167	15	2.30	.110	55	71
1½	3	45	3	12	165	18	183	16	2.75	.130	53	70
2	3	50	3	10	180	18	198	16	3.60	.130	53	70
2½	4	50	3	9	235	22	257	20	5.25	.145	50	68

Style 144

This medium-preheat tip designed for general purpose cutting has four preheat flames. It is extensively used for hand cutting applications over a wide range of plate surface conditions. It is particularly well suited to cut material in excess of eight inches thick with the hand torches mentioned above.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
⅛″	00	4	854-4499
¼″	0	4	854-4400
½″	1	4	854-4401
1″	2	4	854-4402
2″	3	4	854-4403
2½″	4	4	854-4404
4″	5	4	854-4405
7″	6	4	854-4406

CUTTING GUIDE STYLE 144 CUTTING TIP*
MEDIUM PREHEAT FOR RUSTY OR PAINTED SURFACES ON LOW CARBON STEELS
STRAIGHT LINE OR SHAPE CUTTING

THICKNESS INCHES	STYLE 144 TIP SIZE	PRESSURES-P.S.I.		SPEED IN./MIN.	GAS CONSUMPTIONS					KERF WIDTH	CLEANING DRILL	
					CUBIC FEET PER HOUR				CU. FT./ LIN. FT. CUT			
		CUTTING OXYGEN	PREHEAT ACETY.		CUTTING OXYGEN	PREHEAT OXYGEN	TOTAL OXYGEN	PREHEAT ACETY.	CUTTING OXYGEN		CUTTING ORIFICE	PREHEAT ORIFICE
1/8	00	30	1½	23	25	12	33	11	.238	.060	69	66
1/4	0	30	2	20	42	15	57	14	.420	.075	64	64
3/8	1	30	3	19	62	22	84	20	.655	.095	57	62
1/2	1	40	3	17	78	22	100	20	.920	.095	57	62
3/4	2	40	3	15	110	24	134	22	1.47	.110	55	60
1	2	50	3	14	130	24	154	22	1.86	.110	55	60
1½	3	45	3	12	165	25	190	23	2.75	.130	53	59
2	3	50	3	10	180	25	205	23	3.60	.130	53	59
2½	4	50	3	9	235	28	263	25	5.25	.145	50	57
3	5	45	4	8	280	33	313	31	7.00	.165	47	57
4	5	60	4	7	350	33	383	31	10.0	.165	47	57
5	6	50	5	6	410	47	457	43	13.7	.190	42	56
6	6	55	5	5	445	47	492	43	17.8	.190	42	56

Style 164

This tip designed for hand or machine cutting has a six and eight flame heavy preheat. It is particularly suited for work requiring extensive preheat for plate with rust, scale and heavily painted surfaces. It is widely used in scrap yards and shipyards. It fits all the hand cutting torches shown previously and the 4700 series machine cutting torches.

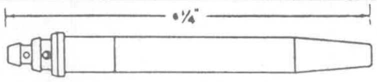
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
1/8″	00	6	854-6499
1/4″	0	6	854-6400
1/2″	1	6	854-6401
1″	2	6	854-6402
2″	3	6	854-6403
2½″	4	6	854-6404
4″	5	6	854-6405
7″	6	6	854-6406
10″	7	6	854-6407
12″	8	6	854-6408
14″	10	6	854-6410
16″	11	6	854-6411
17″	12	8	854-6412
18″	13	8	854-6413

STYLE 164 CUTTING TIP
VERY HEAVY PREHEAT FOR GENERAL CUTTING OF LOW CARBON STEELS
(ALSO FOR USE IN CUTTING CAST IRON AND STAINLESS STEEL)

THICKNESS	STYLE 164 TIP SIZE	PRESSURES-P.S.I.		SPEED	GAS CONSUMPTIONS					KERF WIDTH INCHES	CLEANING DRILL	
					CUBIC FEET PER HOUR				CU. FT./ LIN. FT. CUT			
INCHES		CUTTING OXYGEN	PREHEAT ACETY.	IN./MIN.	CUTTING OXYGEN	PREHEAT OXYGEN	TOTAL OXYGEN	PREHEAT ACETY.	CUTTING OXYGEN		CUTTING ORIFICE	PREHEAT ORIFICE
1/8	00	30	1½	23	25	14	39	13	.238	.060	69	68
1/4	0	30	2	20	42	19	61	17	.420	.075	64	66
3/8	1	30	3	19	62	28	90	25	.655	.095	57	63
1/2	1	40	3	17	78	28	106	25	.920	.095	57	63
3/4	2	40	3	15	110	30	140	27	1.47	.110	55	62
1	2	50	3	14	130	30	160	27	1.86	.110	55	62
1½	3	45	3	12	165	32	197	29	2.75	.130	53	60
2	3	50	3	10	180	32	212	29	3.60	.130	53	60
2½	4	50	3	9	235	34	269	31	5.25	.145	50	59
3	5	45	4	8	280	50	330	45	7.00	.165	47	57
4	5	60	4	7	350	50	400	45	10.0	.165	47	57
5	6	50	5	6	410	57	467	52	13.7	.190	42	57
6	6	55	5	5	445	57	507	52	17.8	.190	42	57
7	6	65	5	4½	505	57	562	52	22.4	.190	42	57
8	7	60	6	4	600	77	677	70	30.0	.220	36	56
10	7	70	6	3½	680	77	757	70	38.8	.220	36	56
12	8	70	6	3	830	77	907	70	55.2	.260	1/8″	56
14	10	85	6	3	1230	86	1316	78	82.0	.345	19	55
16	11	90	6	3	–	–	–	–	–	.390	10	55
17	12	100	6	3	–	–	–	–	–	.445	2	56
18	13	100	6	3	–	–	–	–	–	.500	1/4	56

ACETYLENE TIPS FOR SPECIAL APPLICATIONS

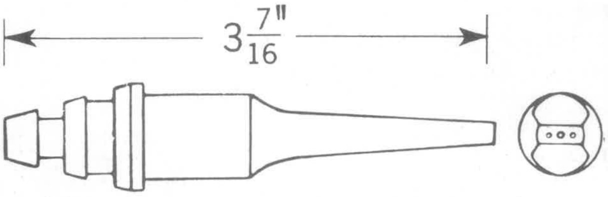
Special application tips include tips of unusual shape or unconventional cutting oxygen geometry. They are used for various purposes such as cutting material in awkward places, wash risers in foundries, gouge cracks in steel castings or various heating jobs such as beam cambering. They fit hand torches Style 1100, 3000, 9000 and 9500. They also fit the 3790, 4700 and 4300 cutting attachments.



STYLE 65 HEATING TIP

This acetylene injector mixing tip has been designed to perform heavy heating jobs.

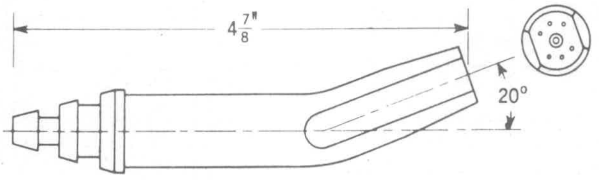
SIZE	STOCK NO.
10	811-6510
11	811-6511
12	811-6512



STYLE 119 STRAIGHT-LINE CUTTING TIP

The Style 119 is a light-preheat tip, milled on two sides. It has special application in the shipbuilding industry in jobs like splitting angle iron, trimming plate, and cutting sheet metal.

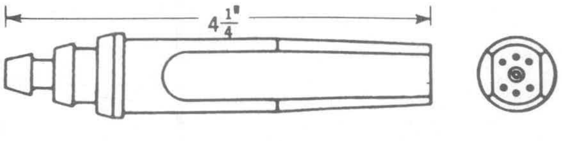
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
¼"	0	2	854-1900
⅜"	1	2	854-1901
½"	2	2	854-1902
¾"	3	2	854-1903



STYLE 183 GOUGING TIP

This Style 183 is a medium-preheat tip, with two sides milled flat for grooving, gouging, and removing imperfect welds. Tip is bent 20°.

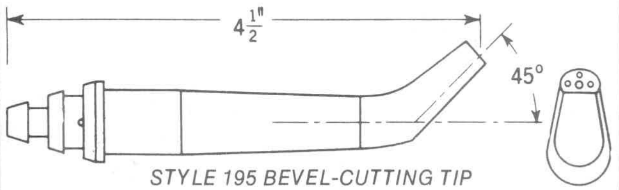
SIZE	PREHEAT FLAMES	STOCK NO.
6	6	854-8306
8	6	854-8308
10	6	854-8310
12	6	854-8312



STYLE 185 RIVET-WASHING TIP

The Style 185 is a medium-preheat tip, with two sides milled flat for grooving, gouging, and removing imperfect welds.

SIZE	PREHEAT FLAMES	STOCK NO.
6	6	854-8506
8	6	854-8508
10	6	854-8510

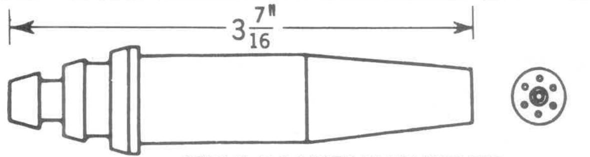


STYLE 195 BEVEL-CUTTING TIP

This is a medium-preheat tip, with one side milled flat. It can be used for hand-cutting rivet heads.

Used with the 4700 series machine cutting torches held perpendicularly, the tip cuts a 45° bevel.

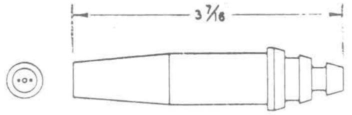
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
⅜"	1	3	854-9501
½"	2	3	854-9502
¾"	3	3	854-9503
1"	4	3	854-9504
2"	5	3	854-9505



STYLE 196 RIVET-WASHING TIP

This style has a flared cutting orifice that provides a large, low-velocity oxygen stream for rivet washing. It has a heavy preheat.

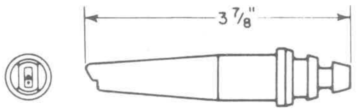
SIZE	PREHEAT FLAMES	STOCK NO.
8	6	854-9608
10	6	854-9610
12	6	854-9612
14	6	854-9614



STYLE 198 CIRCLE-AND-STRAIGHT-LINE CUTTING TIP

A medium-preheat tip, the Style 198 is designed for circular or straight-line cutting of clean plate.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
⅜"	1	2	854-9801
½"	2	2	854-9802
¾"	3	2	854-9803



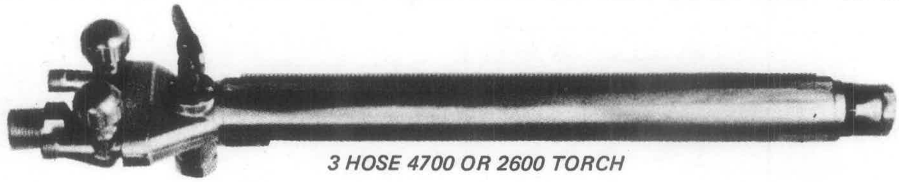
STYLE 205 DRAG TIP

This is a light-preheat, step-type tip suited for hand-cutting sheet metal.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
⅛"	1	1	813-0501
¼"	2	1	813-0502
⅜"	3	1	813-0503

ACETYLENE MACHINE CUTTING TIPS

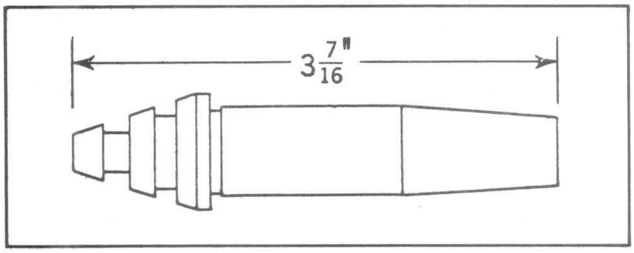
The general purpose tips are currently used with the below machine cutting torches. General purpose tips are often referred as "straight bore tips." They produce good quality cut at moderate cutting speeds. However, the efficiency of modern cutting machine operations is substantially increased with the use of high speed cutting tips. These tips are also referred to as "divergent bore tips." For a given thickness of material the cutting oxygen bore orifices of high speed tips are smaller than general purpose tips. The exit of the orifices are flared out and the cutting oxygen pressure used is higher than with straight bore tips. The end result is a very high velocity and smooth oxygen stream giving a narrow kerf, a high quality face cut and an average of 20% increased cutting speed.



3 HOSE 4700 OR 2600 TORCH

2 HOSE 4700 OR 2600 TORCH

STYLE 45 AND 45M HIGH-SPEED DIVERGENT-TYPE CUTTING TIP



Both of these tip styles are used with the 4700 series machine cutting torches. Style 45 has a light preheat and Style 45M a medium preheat.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STYLE 45 STOCK NO.	STYLE 45M STOCK NO.
1¼″	0	6	813-4500	813-4520
½″	1	6	813-4501	813-4521
1″	2	6	813-4502	813-4522
1½″	3	6	813-4503	813-4523
2½″	4	6	813-4504	813-4524
3½″	6	6	813-4506	813-4526
6″	8	6	813-4508	813-4528
8″	10	6	813-4510	813-4530

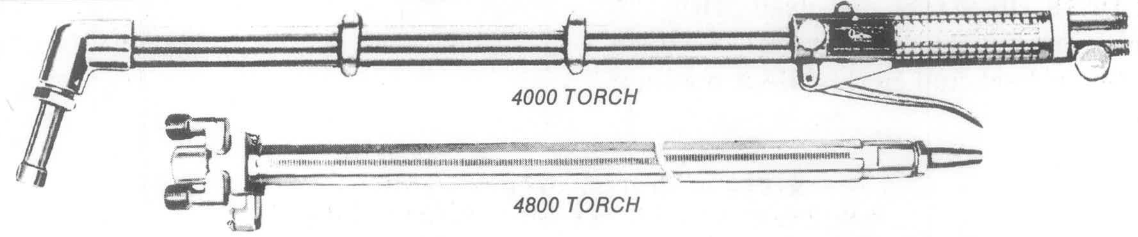
STYLE 45 HIGH SPEED CUTTING TIP MACHINE CUTTING TABLE APPROXIMATE GUIDE

THICKNESS INCHES	STYLE 45 TIP SIZE	PRESSURES-P.S.I.		SPEED IN./MIN.	CUTTING GUIDE CONSUMPTION					KERF WIDTH INCHES	CLEAN-ING ROD NO.
					CUBIC FEET PER HOUR				CU. FT./ LIN. FT. CUT		
		CUTTING OXYGEN	PREHEAT ACETYLENE		CUTTING OXYGEN	PREHEAT OXYGEN	TOTAL OXYGEN	PREHEAT ACETYLENE	CUTTING OXYGEN		
1/4	0	120	3	26	55	15	70	14	.422	.050	0
3/8	1	85	3	24	67	20	87	18	.560	.065	1
1/2	1	100	3	22	78	20	98	18	.710	.065	1
3/4	2	100	3	20	102	20	122	18	1.02	.075	2
1	2	110	3	18	110	20	130	18	1.22	.075	2
1¼	3	85	4	17	125	28	153	25	1.47	.085	3
1½	3	100	4	16	143	28	171	25	1.79	.085	3
2	4	100	4	13	200	28	228	25	3.08	.105	4
2½	4	110	4	12	216	28	244	25	3.60	.105	4
3	6	85	4	10	233	35	268	32	4.65	.120	6
4	8	85	4	9	290	37	327	34	6.45	.135	8
5	8	110	4	8	356	37	393	34	8.90	.135	8
6	8	125	4	7	395	37	432	34	11.2	.135	8
7	10	80	4	6	455	40	495	36	15.2	.170	10
8	10	100	4	5½	540	40	580	36	19.6	.170	10

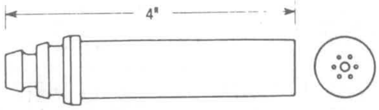
ACETYLENE HEAVY CUTTING & SCARFING TIPS

IMPORTANT

During the past decade the steel industry has practically completed the fuel conversion from acetylene to natural gas for scarfing and heavy cutting operations. As a result, there is a low demand for heavy duty acetylene tips. Among the tips listed below, some are readily available—others are on special order only. In other cases conventional styles of tips have become outdated but the demand still justifies their availability.


4000 TORCH

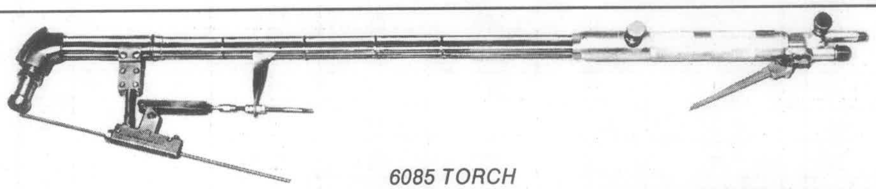
4800 TORCH

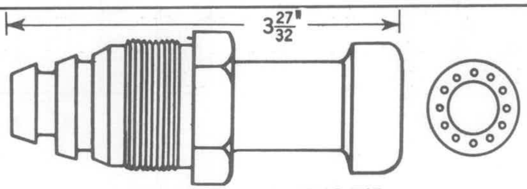


STYLE 168 HEAVY-CUTTING TIP

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
12"	8	6	854-6808
36"	15	8	854-6815

Style 168, designed for heavy cutting applications, fits the 4000 series hand torch up to Size 8 to cut material in excess of 12". For machine cutting application with the 4800 series machine torch, it will cut up to 36" thick material. This style of tip is readily available.


6085 TORCH



STYLE 116 SCARFING TIP

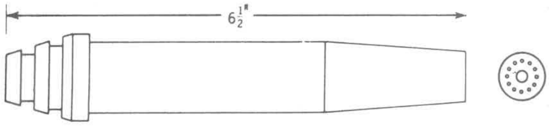
SIZE	PREHEAT FLAMES	STOCK NO.
20	12	854-1620

Style 116 is a heavy preheat scarfing tip for use with the 6085 torch shown above. A hard face wear ring protects the tip end. This tip is available on special order.

ACETYLENE HEAVY CUTTING & SCARFING TIPS

6590 TORCH

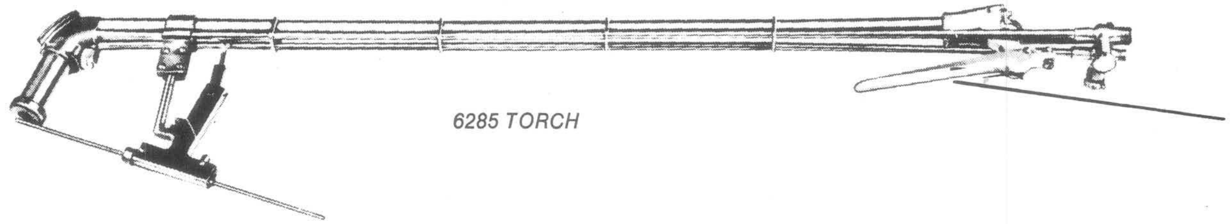
6550 TORCH



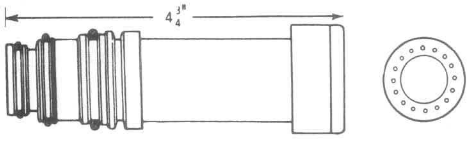
STYLE 174 HEAVY-DUTY CUTTING TIP

Style 174 heavy duty cutting tip is used for hand operation with the 6550 and 6590 hand cutting torches shown. With adapter 831-1586, the style 174 fits on the 6850 heavy duty machine torch often referred to as the "horse" torch. The material thickness range of this style of tip is from 36 to 48 inches. It is available on special order.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
36″	15	12	854-7415
48″	18	12	854-7418



6285 TORCH

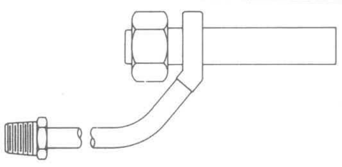


STYLE 222 SCARFING TIP

SIZE	PREHEAT FLAMES	STOCK NO.
24	16	813-1624

This heavy scarfing tip is designed for use with the 6200 series scarfing torch. It is furnished with soft seat sealing rings. The tip end is protected by a hard face wear ring. Available on special order.

6850 "HORSE" TORCH



STYLE 101 HEAVY-DUTY CUTTING TIPS

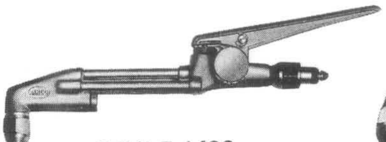
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STYLE 101 STOCK NO.
72″	24	16	854-1013
84″	26	16	854-1014

These tips can cut thicknesses to 84 inches with the Style 6850 heavy-duty machine or "horse" torch. Available on special order.

SUMMARY CHART
ACETYLENE TIPS

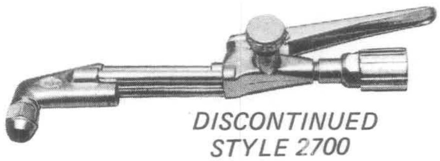
APPLICATIONS	AIRCO TORCHES	TIP STYLES
HAND CUTTING	1490 & 2400 Cutting Attachments 2700 Cutting Attachment	112 145
GENERAL PURPOSE	4700 & 4800 Cutting Attachments 3700 & 3800 Cutting Attachments 9500, 9000, 1100 Hand Torches 4700 Machine Torch	124 138, 144 164
MACHINE CUTTING	4700 Machine Torch	45 & 45M
SPECIAL APPLICATIONS	3700 & 3800 Cutting Attachments 4700 & 4800 Cutting Attachments 9500, 9000 & 1100 Hand Torches	119, 183 185 195, 196, 198 205, 65
SCARFING HEAVY CUTTING & OUTDATED	4000, 6085, 6200, 6550, 6590 Hand Torches 4800 & 6850 Heavy Cutting Torches	116, 168 174, 222 101 155

MAPP GAS
PROPANE AND NATURAL GAS
HAND CUTTING TIPS

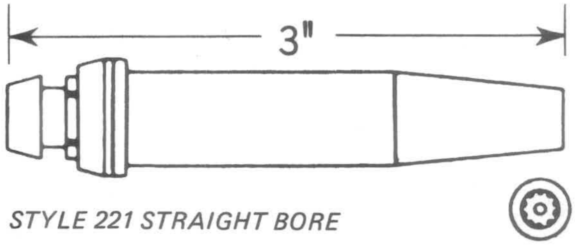


STYLE 1490
CUTTING ATTACHMENT

DISCONTINUED
STYLE 2400
CUTTING ATTACHMENT



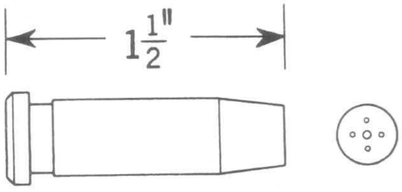
DISCONTINUED
STYLE 2700
CUTTING ATTACHMENT



STYLE 221 STRAIGHT BORE

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
¼"	0	10	813-1540
½"	1	10	813-1541
1"	2	10	813-1542
1¼"	3	10	813-1543
2"	4	10	813-1544

The Style 221 tips for propane or natural gas is of the two piece design and has a tapered 2 land seat. It is used for hand cutting on material up to 3" thick with the Style 2700 cutting attachment shown above and the Style 700 torch. To cut material in excess of 4", the Style 2700 cutting attachment must be mounted on a Style 750 torch.



STYLE 132 (AA) STRAIGHT BORE

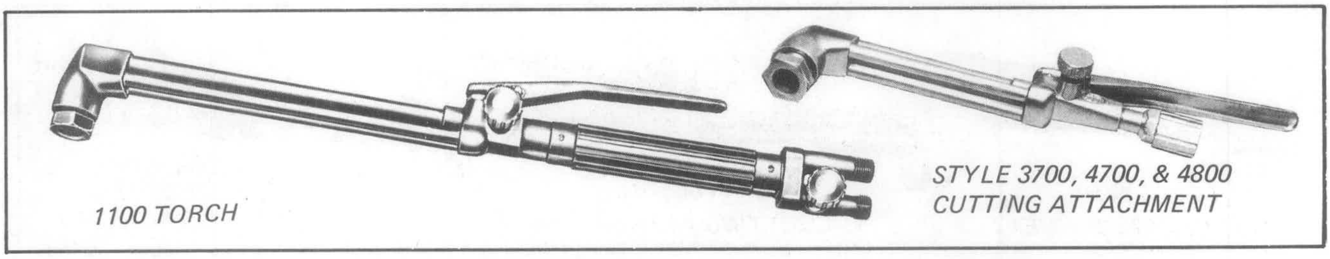
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
1/8"	00	4	854-3299
¼"	0	4	854-3200
1½"	1	6	854-3201
2"	2	6	854-3202
3"	3	6	854-3203

The Style 132 is for MAPP Gas use. It is of the one piece design. It can also be used with acetylene when extra heavy preheat is required for highly oxidized work or cast iron cutting.

Style 132 is used with the Style 1490 cutting attachment which fits the Style 300 or 400 torch to cut material up to 1-1/2" thick. It is also used with Style 2400 cutting attachment for Style 700* or 750 torch to cut material up to 3" thick.

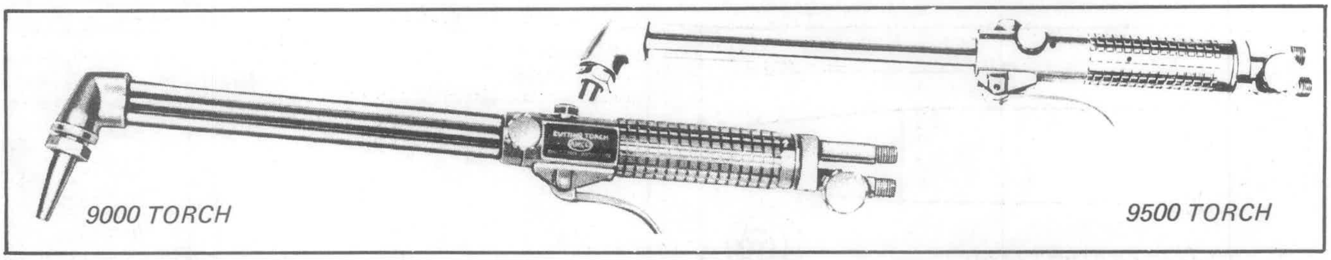
*700 torch is discontinued

MAPP GAS
PROPANE AND NATURAL GAS
GENERAL PURPOSE CUTTING TIPS
AIRCO POSITIVE PRESSURE HAND TORCHES



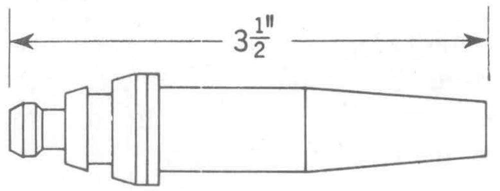
1100 TORCH

STYLE 3700, 4700, & 4800 CUTTING ATTACHMENT



9000 TORCH

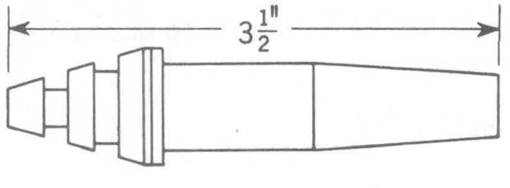
9500 TORCH



STYLE 261 – STRAIGHT BORE

The Style 261 is of the two piece design for propane and natural gas use. The insert has 36° Vee splines for ruggedness, ease of maintenance and exceptional flame stability with heavy preheat flow. It fits any of the torches shown above to cut material in excess of 8 inches. It also fits machine torches shown further to cut material up to 14 inches.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
3/16"	0	10	813-2611
1/2"	1	10	813-2612
1"	2	10	813-2613
2"	3	10	813-2614
4"	5	13	813-2615
8"	7	13	813-2617
12"	8	13	813-2618
14"	10	13	813-2619



STYLE 263 – STRAIGHT BORE

The Style 263 is a two piece tip for propane and natural gas use similar to Style 261. The difference between these tips is in the preheat pattern. The insert splines are 22° Vee providing a tight ring of flames for maximum heat transfer efficiency in piercing and fast starting. It fits all the torches shown above.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
3/16"	0	14	813-2630
1/2"	1	14	813-2631
1"	2	14	813-2632
2"	3	14	813-2633
4"	5	18	813-2635
8"	7	18	813-2637

MAPP GAS
PROPANE AND NATURAL GAS
GENERAL PURPOSE CUTTING TIPS
CUTTING GUIDE STYLE 263 DATA

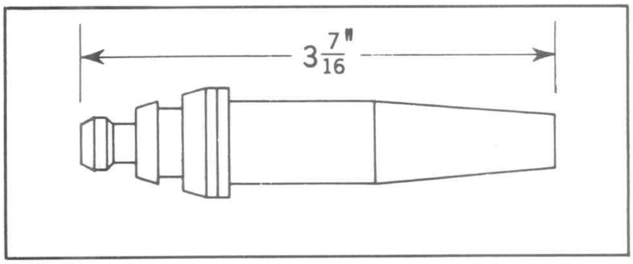
Torches: Series 2600, 2900, 3000, 9000, 9500 and 4700
CUTT. ATT. 3700, 3800, 4700 and 4800
FOR USE WITH NATURAL GAS

Mtl. Thick	Tip Size	Cutt. Speed		Total Oxygen		Natural Gas		Clean. Drill	Kerf
		Quality	Sever-ance	PSI	CFH	PSI	CFH		
⅛	00	18	24	25	39	3	18	76	.03
3⁄16	00	18	24	30	41	3	18	76	.03
¼	0	20	24	30	60	3	23	69	.05
⅜	1	17	22	45	90	4	23	62	.07
½	1	15	21	50	97	4	25	62	.07
¾	2	14	19	45	105	4	25	57	.08
1	2	13	18	50	115	4	25	57	.08
1¼	3	11	16	45	175	4	25	54	.12
1½	3	10	14	50	190	4	25	54	.12
2	3	9	12	55	205	4	25	54	.12
2½	5	8	12	45	335	5	35	47	.12
3	5	8	11	50	365	5	35	47	.16
4	5	7	9	55	385	5	35	47	.16
6	7	6	8	45	535	5	35	40	.19
8	7	5	7	55	630	5	35	40	.19

Torches: Series 2600, 2900, 3000, 9000, 9500 and 4700
CUTT. ATT. 3700, 3800, 4700 and 4800
FOR USE WITH PROPANE GAS

Mtl. Thick	Tip Size	Cutt. Speed		Total Oxygen		Propane		Clean. Drill	Kerf
		Quality	Sever-ance	PSI	CFH	PSI	CFH		
⅛	00	18	24	25	39	2	5	76	.03
3⁄16	00	18	24	30	41	2	5	76	.03
¼	0	20	24	30	60	2	8	69	.05
⅜	1	17	22	45	90	3	10	62	.07
½	1	15	21	50	97	3	11	62	.07
¾	2	14	19	45	105	3	11	57	.08
1	2	13	18	50	115	3	11	57	.08
1¼	3	11	16	45	175	3	11	54	.12
1½	3	10	14	50	190	3	11	54	.12
2	3	9	12	55	205	3	11	54	.12
2½	5	8	12	45	335	4	15	47	.12
3	5	8	11	50	365	4	15	47	.16
4	5	7	9	55	385	4	15	47	.16
6	7	6	8	45	535	4	15	40	.19
8	7	5	7	55	630	4	15	40	.19

CUTTING GUIDE STYLE 264 (AFS) FOR MAPP® GAS



The Style 264 for MAPP Gas use is of the two piece design. The insert has thin rectangular splines for high heat transfer efficiency. It is preferred for work requiring fast starting and piercing.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
3/16"	0	18	813-2640
1/2"	1	18	813-2641
1"	2	18	813-2642
2"	3	18	813-2643
4"	5	22	813-2645
8"	7	22	813-2647
12"	8	26	813-2648
14"	10	26	813-2649

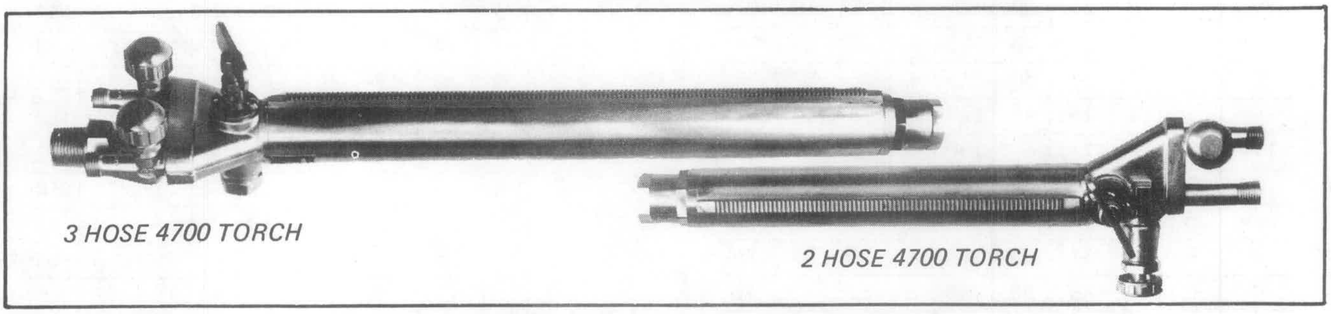
Torches: Series 2600, 2900, 3000, 9000, 9500 and 4700
CUTT. ATT. 3700, 3800, 4700 and 4800
FOR USE WITH MAPP GAS

Mtl. Thick	Tip Size	Cutt. Speed		Total Oxygen		Propane		Clean. Drill	Kerf
		Quality	Sever-ance	PSI	CFH	PSI	CFH		
⅛	0	18	24	20	35	2	5	69	.05
3⁄16	0	18	24	25	38	2	5	69	.05
¼	0	20	24	30	55	2	8	69	.05
⅜	1	17	22	45	90	3	10	62	.07
½	1	15	21	50	97	3	11	62	.07
¾	2	14	19	45	105	3	11	57	.08
1	2	13	18	50	115	3	11	57	.08
1¼	3	11	16	45	175	3	11	54	.12
1½	3	10	14	50	190	3	11	54	.12
2	3	9	12	55	205	3	11	54	.12
2½	5	8	12	45	335	4	15	47	.16
3	5	8	11	50	365	4	15	47	.16
4	5	7	9	55	385	4	15	47	.16
6	7	6	8	45	535	4	15	40	.19
8	7	5	7	55	630	4	15	40	.19
10	8	3-4	6	50	830	5	20	⅛	.25
12	8	3	5	55	885	5	25	⅛	.25
14	10	2	4	60	1020	5	25	19	.34

MAPP GAS
PROPANE AND NATURAL GAS
MACHINE CUTTING TIPS

The general purpose tips shown previously are currently used with the machine cutting torches shown below. General purpose tips are often referred to as "straight bore tips." They produce good quality cut at moderate cutting speeds. However, the efficiency of modern cutting machine operations is substantially increased with the use of high speed cutting tips. These tips are also referred to as "divergent bore tips." For a given thickness of material the cutting oxygen bore orifices of high speed tips are smaller than general purpose tips. The exit of the orifices are flared out and the cutting oxygen pressure used is higher than with straight bore tips. The end result is a very high velocity and smooth oxygen stream giving a narrow kerf, a high quality face cut and an average of 20% increased cutting speed.

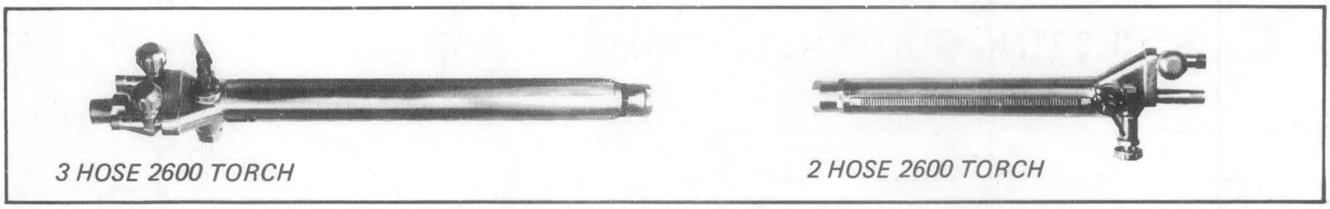
POSITIVE PRESSURE TORCHES



3 HOSE 4700 TORCH

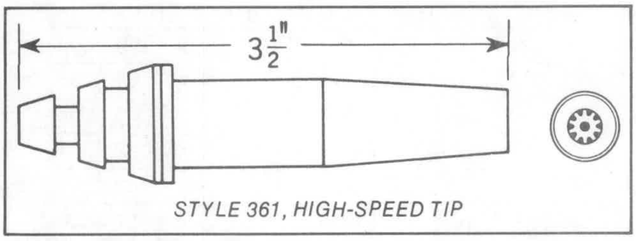
2 HOSE 4700 TORCH

LOW PRESSURE INJECTOR TORCHES



3 HOSE 2600 TORCH

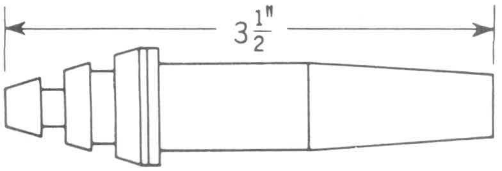
2 HOSE 2600 TORCH



STYLE 361, HIGH-SPEED TIP

The Style 361 is a two piece tip designed for propane and natural gas use. It has a divergent cutting oxygen bore for highspeed and high quality cutting. The preheat 36° Vee splines give a great preheat flame stability at high flow. It fits machine cutting torches.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
¼″	0	7	813-3619
½″	1	10	813-3611
1″	2	10	813-3612
1½″	3	10	813-3613
2½″	4	10	813-3614
3″	6	10	813-3615
6″	8	10	813-3616
8″	10	13	813-3617



STYLE 363 HIGH PRODUCTION CUTTING TIPS

The Style 363 is a two piece tip designed for propane and natural gas use. It differentiates from other high speed cutting tips by having larger divergent cutting oxygen orifices and 22° preheat Vee splines for improved cut retention. It permits higher cutting speed than conventional high speed cutting tips. The resulting cuts are of sufficient quality to satisfy steel fabricators. It fits on all the torches shown above.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
¾"	1	14	813-3631
1¼"	2	14	813-3631
2"	3	14	813-3631
3"	4	14	813-3631
4"	5	20	813-3631
6"	6	20	813-3631

APPROXIMATE HIGH PRODUCTION CUTTING GUIDE – NAT. GAS & PROPANE
MULTITORCH MACHINE CUTTING 2600 SERIES TORCHES

MTL. THICK. IN.	CUTTING TIP STYLE		CUT. SPEED INCHES MIN.	CUTTING OXYGEN		FUEL MANIFOLD PRESSURE 0 TO 1 PSI												CUT. PORT DRILL SIZE	KERF WIDTH INCHES
						NATURAL GAS PREHEAT						PROPANE GAS PREHEAT							
						HIGH			LOW			HIGH			LOW				
	3 LANDS	TIP NO.		PRESS. PSI	FLOW CFH	OXYGEN		FUEL	OXYGEN		FUEL	OXYGEN		FUEL	OXYGEN		FUEL		
						PSI	CFH	CFH	PSI	CFH	CFH	PSI	CFH	CFH	PSI	CFH	CFH		
1/8	263	00	18-24	20	10	**			10	26	18	**			8	20	6*	.021	.04
3/16	263	00	18-24	25	12				10	26	18				8	20	6*	.021	.04
1/4	263	0	20-24	30	25	35	64	32	18	36	23	35	64	13	12	25	8*	.031	.06
3/8	263	0	20-25	45	35	40	72	36	20	40	25	40	72	14	15	32	10	.031	.06
1/2	363	1	24-26	75	110	45	80	40	20	40	25	45	80	16	20	40	12	.039	.08
3/4	363	1	21-24	85	120	45	80	40	20	40	25	45	80	16	20	40	12	.039	.08
1	363	2	19-22	85	145	45	80	40	20	40	25	45	80	16	20	40	12	.046	.09
1¼	363	2	17-20	90	155	45	80	40	20	40	25	45	80	16	20	40	12	.046	.09
1½	363	3	15-17	75	240	45	80	40	20	40	25	45	80	16	20	40	12	.055	.11
2	363	3	14-16	85	260	45	80	40	20	40	25	45	80	16	20	40	12	.055	.11
2½	363	4	13-15	85	325	45	80	40	20	40	25	45	80	16	20	40	12	.063	.12
3	363	4	12-14	100	370	45	80	40	20	40	25	45	80	16	20	40	12	.063	.12
4	363	5	10-11	85	450	50	88	44	25	50	35	50	88	18	25	50	15	.076	.14
6	263	7	6-7	45	485	50	88	44	25	50	35	50	88	18	25	50	15	.098	.19
8	263		5-6	55	575	50	88	44	35	64	44	50	88	18	35	64	18	.098	.19
10	263	8	4-5	50	750	40	70	48	***			40	70	22	*****			.125	.26
12	263	8	3-4.5	55	810	40	70	48				40	70	22				.125	.26
14	263	10	.3	60	945	40	70	48				40	70	22				.166	.34

* These preheat flows are fuel rich. The flames are to be trimmed individually.

** It is not recommended to use high preheat flames on thin gauge. It can be done. Gas pressures and flows will depend on the particular installation.

*** No low preheat setting on Heavy Cutting. In this range, full rich medium preheat is best to obtain long secondary flame extending deep in the kerf.

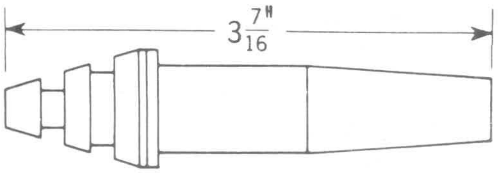
APPROXIMATE HIGH PRODUCTION CUTTING GUIDE – NAT. GAS – PROPANE
MULTITORCH MACHINE CUTTING 4700 SERIES TORCHES

MTL. THICK. IN.	CUTTING TIP		CUT. SPEED INCHES MIN.	CUTTING OXYGEN		PREHEAT MANIFOLD PRESSURES & FLOWS												CUT. PORT DRILL SIZE	KERF WIDTH INCHES
						HIGH						LOW							
						OXYGEN		NAT. GAS		PROPANE		OXYGEN		NAT. GAS		PROPANE			
	STYLE	NO.		PRESS. PSI	FLOW CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
1/8	263	00	18-24	20	10	**						3	20	2	18	2	6*	.031	.05
3/16	263	00	18-24	25	12							3	20	2	18	2	6*	.031	.05
1/4	263	0	20-24	30	25	6	64	4	32	3	13	3	25	2	23	2	8*	.031	.05
3/8	263	0	20-25	45	35	7	72	4	36	4	14	4	32	3	25	2	10	.031	.05
1/2	363	1	24-26	75	110	8	80	4	40	4	16	4	40	3	25	3	12	.039	.08
3/4	363	1	21-24	85	120	8	80	4	40	4	16	4	40	3	25	3	12	.039	.08
1	363	2	19-22	85	145	8	80	4	40	4	16	4	40	3	25	3	12	.046	.09
1¼	363	2	17-20	90	155	8	80	4	40	4	16	4	40	3	25	3	12	.046	.09
1½	363	3	15-17	75	240	8	80	4	40	4	16	4	40	3	25	3	12	.055	.11
2	363	3	14-16	85	260	8	80	4	40	4	16	4	40	3	25	3	12	.055	.11
2½	363	4	13-15	85	325	8	80	4	40	4	16	4	40	3	25	3	12	.063	.12
3	363	4	12-14	100	370	8	80	4	40	4	16	4	40	3	25	3	12	.063	.12
4	363	5	10-11	85	450	9	88	5	44	5	18	5	50	4	35	4	15	.076	.14
6	263	7	6-7	45	485	9	88	5	44	5	18	5	50	4	35	4	15	.098	.19
8	263	7	5-6	55	575	9	88	5	44	5	18	6	64	5	44	5	18	.098	.19
10	263	8	4-5	50	750	9	88	6	60	7	26	***						.125	.26
12	263	8	3-4.5	55	810	9	88	6	60	7	26							.125	.26
14	263	10	3	60	945	9	88	6	60	7	26							.166	.34

* These preheat flows are fuel rich. The flames are to be trimmed individually.

** It is not recommended to use high preheat flames on thin gauge. It can be done. Gas pressures and flows will depend on the particular installation.

*** No low preheat setting on Heavy Cutting. In this range, full rich medium preheat is best to obtain long secondary flame extending deep in the kerf.



STYLE 364 HIGH SPEED MAPP TIPS*

The Style 364 for MAPP Gas use is of the two piece design. The insert has thin rectangular splines. It is recommended for fast start and piercing operations. The large divergent cutting oxygen bores are similar to the bores of the Style 363 for high production cutting. It fits on all the torches shown above.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
¾"	1	18	813-3641
1¼"	2	18	813-3642
2"	3	18	813-3643
3"	4	18	813-3644
4"	5	22	813-3645
6"	6	22	813-3646

Clean divergent cutting port with fiber =832 3420.

APPROXIMATE HIGH PRODUCTION CUTTING GUIDE MAPP MULTITORCH MACHINE CUTTING 2600 SERIES TORCHES

MTL. THICK. IN.	CUTTING TIP		CUT. SPEED INCHES MIN.	CUTTING OXYGEN		FUEL MANIFOLD PRESSURE 0 TO 1 PSI						CUT. PORT DRILL SIZE	KERF* WIDTH INCHES
						MAPP GAS PREHEAT							
						HIGH			LOW				
						OXYGEN		FUEL	OXYGEN		FUEL		
	STYLE	NO.		PSI	CFH	PSI	CFH	CFH	PSI	CFH	CFH		
1/3	264	0	18-24	20	20	**			5	10	5	.031	.05
3/16	264	0	18-24	20	20				5	10	5	.031	.05
1/4	264	0	20-24	30	25	22	45	13	7	14	7	.031	.05
3/8	264	0	20-25	45	35	26	50	14	8	20	10	.031	.05
1/2	364	1	24-26	75	110	26	50	14	8	20	10	.039	.08
3/4	364	1	21-24	85	120	26	50	14	8	20	10	.039	.08
1	364	2	19-22	35	145	26	50	14	8	20	10	.046	.09
1¼	364	2	17-20	90	155	26	50	14	8	20	10	.046	.09
1½	364	3	15-17	75	240	26	50	14	8	20	10	.055	.11
2	364	3	14-16	85	260	26	50	14	8	20	10	.055	.11
2½	364	4	13-15	85	325	26	50	14	12	24	12	.063	.12
3	364	4	12-14	100	370	34	60	17	12	24	12	.063	.12
4	364	5	10-11	85	450	34	60	17	12	24	12	.076	.14
6	264	7	6-7	45	485	34	60	17	12	24	12	.098	.19
8	264	7	5-6	55	575	34	60	17	12	24	12	.098	.19
10	264	8	4-5	50	750	22	45	18	***			.125	.26
12	264	8	3-4.5	55	810	22	45	20				.125	.26
14	264	10	3	60	945	22	45	20				.166	.34

* These preheat flows are fuel rich. The flames are to be trimmed individually.

** It is not recommended to use high preheat flames on thin gauge. It can be done. Gas pressures and flows will depend on the particular installation.

*** No low preheat setting on Heavy Cutting. In this range, full rich medium preheat is best to obtain long secondary flame extending deep in the kerf.

APPROXIMATE HIGH PRODUCTION CUTTING GUIDE MAPP MULTITORCH MACHINE CUTTING 4700 SERIES TORCHES

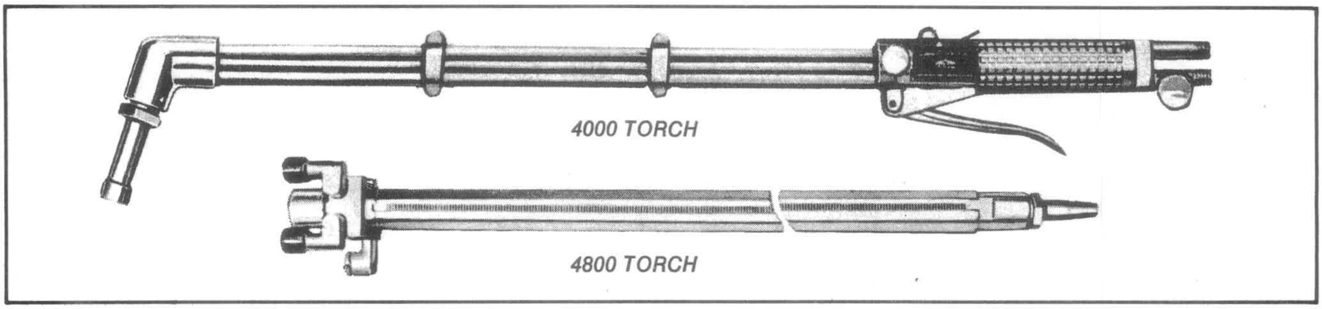
MTL. THICK. IN.	CUTTING TIP		CUT. SPEED INCHES MIN.	CUTTING OXYGEN		PREHEAT MANIFOLD – PRESSURES & FLOWS								CUT. PORT DRILL SIZE	KERF* WIDTH INCHES
						MAPP									
						HIGH				LOW					
						OXYGEN		FUEL		OXYGEN		FUEL			
	STYLE	NO.		PRESS. PSI	FLOW CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
1/8	264	0	18-24	20	20	**				2	10	2	5	.031	.05
2/16	264	0	18-24	20	20					2	10	2	5	.031	.05
1/4	264	0	20-24	30	25	5	45	3	13	2	14	2	7	.031	.05
3/8	264	0	20-25	45	35	5	50	4	14	3	20	3	10	.031	.05
1/2	364	1	24-26	75	110	5	50	4	14	3	20	3	10	.039	.08
3/4	364	1	21-24	85	120	5	50	4	14	3	20	3	10	.039	.08
1	364	2	19-22	85	145	5	50	4	14	3	20	3	10	.046	.09
1¼	364	2	17-20	90	155	5	50	4	14	3	20	3	10	.046	.09
1½	364	3	15-17	75	240	5	50	4	14	3	20	3	10	.055	.11
2	364	3	14-16	85	260	5	50	4	14	3	20	3	10	.055	.11
2½	364	4	13-15	85	325	5	50	4	14	4	24	4	12	.063	.12
3	364	4	12-14	100	370	6	60	5	17	4	24	4	12	.063	.12
4	364	5	10-11	85	450	6	60	5	17	4	24	4	12	.076	.14
6	264	7	6-7	45	485	6	60	5	17	4	24	4	12	.098	.19
8	264	7	5-6	55	575	6	60	5	17	4	24	4	12	.098	.19
10	264	8	4-5	50	750	5	45	5	18	***				.125	.26
12	264	8	3-4.5	55	810	5	45	5	20					.125	.26
14	264	10	3	60	945	5	45	5	20					.166	.34

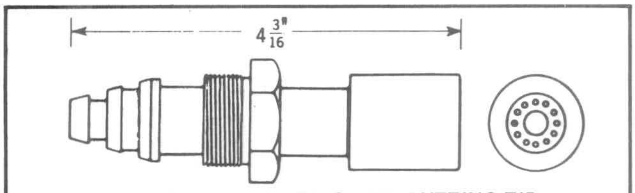
* These preheat flows are fuel rich. The flames are to be trimmed individually.

** It is not recommended to use high preheat flames on thin gauge. It can be done. Gas pressures and flows will depend on the particular installation.

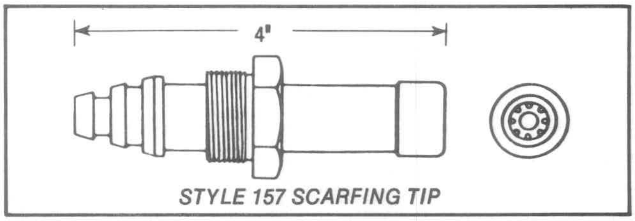
*** No low preheat setting on Heavy Cutting. In this range, full rich medium preheat is best to obtain long secondary flame extending deep in the kerf.

PROPANE AND NATURAL GAS TIPS
SCARFING AND HEAVY CUTTING





STYLE 149 SCARFING AND CUTTING TIP



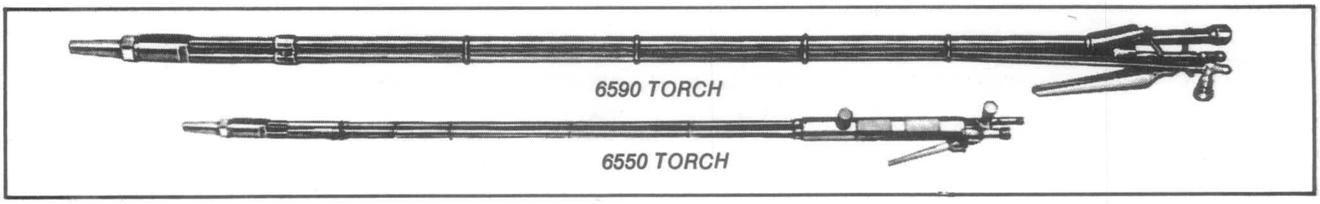
STYLE 157 SCARFING TIP

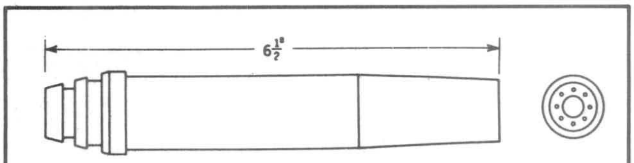
Style 149 is a one piece scarfing and cutting tip with captive nut to fit the above hand and machine cutting torches. It is also used for heavy cutting. It will cut material in excess of 15 inches with the 4000 series hand torch and up to 24 inches with the 4800 series machine torches.

MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
18"	13	12	854-4913
24"	15	12	854-4915

Style 157 scarfing is a one piece tip with a captive nut. It is used with the 4000 series hand torch shown above.

SIZE	PREHEAT FLAMES	STOCK NO.
13	8	854-5713
15	8	854-5715



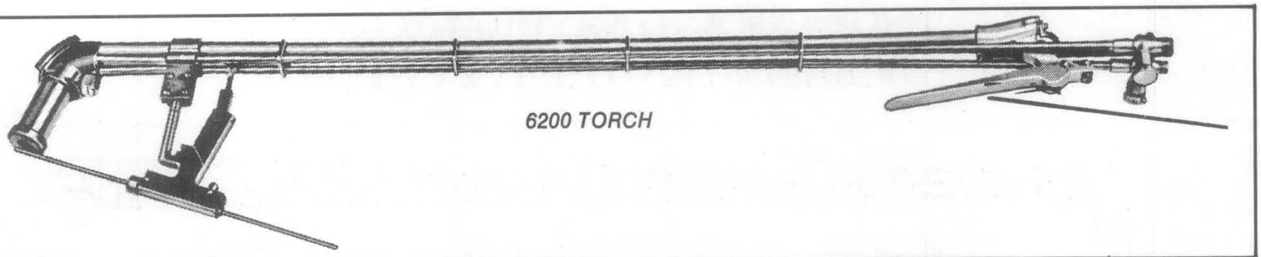


STYLE 213 HEAVY-DUTY CUTTING TIP

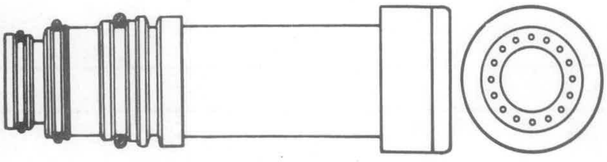
MATERIAL THICKNESS	SIZE	PREHEAT FLAMES	STOCK NO.
14"	10	8	813-1060
28"	14	12	813-1064
48"	18	12	813-1068

Style 213 is a one piece tip for heavy cutting. It fits the above shown hand torches. With adapter 831-1586 it can also be used with the

Style 6850 heavy duty "horse" machine cutting torch shown above. Available on special order only.



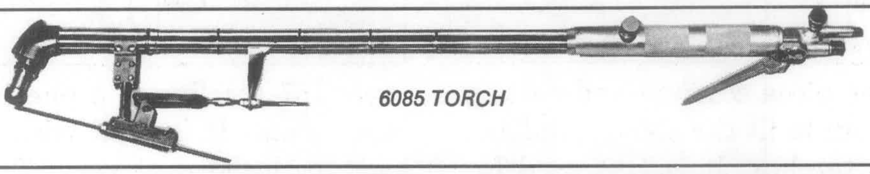
6200 TORCH



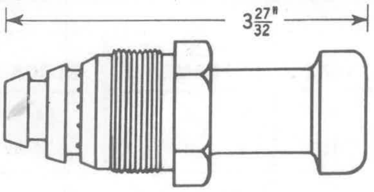
STYLE 223 SCARFING TIP

SIZE	PREHEAT FLAMES	STOCK NO.
24	16	813-1724

The Style 223 is a heavy preheat scarfing tip. It is furnished with soft seat sealing rings. It has a heavy wear ring. It fits the 6200 series scarfing torch shown above.



6085 TORCH

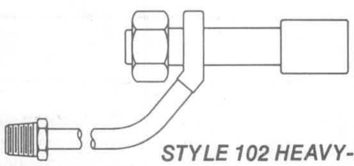


STYLE 225 SCARFING TIP

SIZE	PREHEAT FLAMES	STOCK NO.
17	12	813-2017
18	12	813-2018
20	12	813-2020
22	12	813-2022

The Style 225 scarfing tip is of the two piece design. The shell has a captive nut and heavy wear ring. The insert has twelve rectangular splines to provide a heavy preheat.

6850 "HORSE" TORCH



STYLE 102 HEAVY-DUTY CUTTING TIPS

Material Thickness	Size	Preheat Flames	Style 102 Stock No.
48″	20	12	854-1020
60″	22	16	854-1022

The Style 102 heavy cutting tip can cut material in excess of 60 inches thick with the 6850 "horse" torch shown above. Available on special order only.

SUMMARY CHART
PROPANE, NATURAL GAS & MAPP TIPS

APPLICATIONS	AIRCO TORCHES	TIP STYLES
GENERAL PURPOSE	4700 & 4800 Cutting Attachments 3700 & 3800 Cutting Attachments 9500, 9000, 2900 & 1100 Hand Torches 4700 & 2600 Machine Torches	121 (ASP) 261, 263 264 (AFS)
HAND CUTTING	1400 Cutting Attachment 2700 Cutting Attachment	132 (AA) SP 221
MACHINE CUTTING	4700 & 2600 Machine Torches	114 (AHS) 361, 363 364 (AFH)
SPECIAL APPLICATIONS	4700 & 4800 Cutting Attachments 3700 & 3800 Cutting Attachments 9500, 9000, 2900, & 1100 Hand Torches	287 297, 745
SCARFING & HEAVY CUTTING	4000, 6085, 6200, 6550, 6590 Hand Torches 4800 & 6850 Heavy Machine Torches	149, 157 213 223, 225 102
OUTDATED TIPS (REFERENCE)	3700, 4700, 3800 & 4800 Cutting Attachments 9500, 9000, 2900, 1100 Hand Torches 4700 & 2600 Machine Torches 2000 & 2500 Phased Out Torches	219, 229 251, 351 224

7. MASTER TIPS

PROPANE, NATURAL GAS AND MAPP®TIPS

Airco has recently introduced a new line of cutting tips that provide substantial cost savings and fexibility. Master tips consist of four styles, two styles for general purpose cutting and two styles for machine cutting. In addition, a variety of seat blocks are available to adapt our Master tips to popular torches and cutting attachments.

FEATURES

Airco Torches —
Positive and low pressure injector seat blocks are available to fit Airco cutting attachments and torches.

Competitive Torches—
Seat blocks are available to fit Airco Master tips to Harris, Smith, and Victor Torches.

Fuel Gases—
Master tips are used with Propane, Natural Gas or MAPP® Gas.

Preheat Splines—
Available are thin rectangular splines for high heat transfer, 22° Vee splines for high flame stability, 36° Vee splines for heavy cutting.

Cutting Oxygen Bore—
Straight bore for general purpose cutting,—Divergent bore for Machine cutting.

Interchangeable Shells and Inserts—
Change the insert to modify cutting thickness.

Cost Saving:
Assemblies—Tip Assemblies cost less than present one piece tips.

Components—When changing size, style or fuels, only certain components need to be changed, not the whole tip.

STOCK NUMBERS

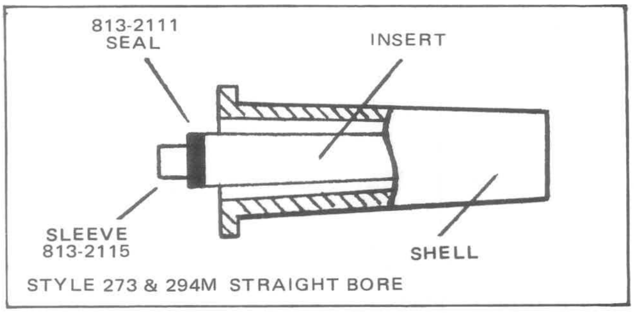
Torches	Hand Torches	Machine Torches	Cutting At'ments.	Seat Blocks
Airco	1100, 9000, 9500 Series	4700 Series	3700, 3800, 4700, 4800 Series	831-2873 Positive Pressure 831-2904 Low Press.
	2900 Series	2600 Series	—	831-2903
Harris	24-2, 42-2, 62-3 Series	98-2 Series	49, 72, 73 Series	831-2872
Smith	Silver Star, Tuf Tony	High Capacity SC780A, SC781A, SC782A	Silver Star, Pipewelders Special, Pipeliner	831-2871
Victor	ST1000, 1100, 1200, 1300, 1500, SST1000, STN2000, STN2300	MT Series 200C,205C 210C,260C 300C,320C 505,510, MTN Series 300C,320C, 1200, 1205, 121C, 1260, 1505, 1510, FG5A FGN5A	CA 1050, CAN 1050, 2450	831-2900

NOTE: To insure proper seating of seat blocks on a used torch, the torch head should be finish reamed prior to assembly. Tip nut supplied with Seat Blocks is 831-2870.

PROPANE, NATURAL GAS AND MAPP GENERAL PURPOSE CUTTING

Style 273 General Purpose Tips

The Style 273 Master Tip is a two piece tip for propane and natural gas. The insert splines are 22° Vee providing a tight ring of 14 preheat flames for maximum heat transfer efficiency in piercing and fast starting. This style is suggested as a replacement for Style 263.



STYLE 273 & 294M STRAIGHT BORE

		NATURAL GAS & PROPANE		
Material Thickness	Size	Style 273 Assembly No.	Style 273 Shell No.	Style 273 & 273M Insert No.
3/16″	00	813-2799	813-2116	813-2120
5/16″	0	813-2730	813-2116	813-2121
1/2″	1	813-2731	813-2116	813-2122
1″	2	813-2732	813-2116	813-2123
1-1/2″	3	813-2733	813-2116	813-2124
2-1/2″	4	813-2734	813-2116	813-2125
4″	5	813-2735	813-2116	813-2126

Style 294M General Purpose Tip

The Style 294M for MAPP® Gas is of the two piece design. The insert has thin rectangular splines with 16 preheat flames for high heat transfer efficiency. It is preferred for work requiring fast starting and piercing. This style is suggested as a replacement for Style 264.

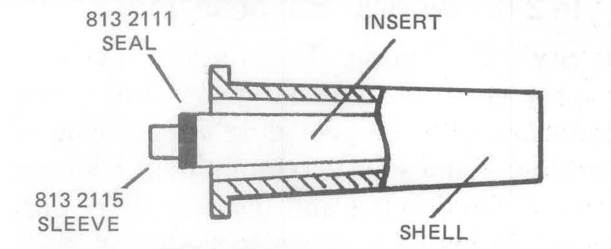
		MAPP GAS		
Material Thickness	Size	Style 294M Assembly No.	Style 294M Shell No.	Style 294M & 294 Insert No.
5/16″	0	813-2740	813-2117	813-2127
1/2″	1	813-2741	813-2117	813-2128
1″	2	813-2742	813-2117	813-2129
1-1/2″	3	813-2743	813-2117	813-2130
2-1/2″	4	813-2744	813-2117	813-2131
4″	5	813-2745	813-2117	813-2132

813-2111 seal and 813-2115 sleeve are required for each tip. These parts are included in the assembly.
As a replacement part 813-2115 sleeve in package of 10 ea. order 813-2153, in package of 100 ea. order 813-2154.
As a replacement part 813-2111 seal in package of 10 ea. order 813-2151, in package of 100 ea. order 813-2152.

PROPANE, NATURAL GAS AND MAPP MACHINE CUTTING TIPS

Style 373 Divergent Tips

The Style 373 is a two piece tip designed for propane and natural gas. It permits high speed, high quality cutting or high production cutting (i.e. higher cutting speed with resulting cuts of sufficient quality to satisfy steel fabricators). Sizes 0 through 5 have fourteen 22° Vee spline preheats, Sizes 7, 8, and 10 have 36° Vee spline preheats. Sizes 0 through 5 have divergent cutting oxygen orifices, Sizes 7, 8 & 10 have straight bore cutting oxygen orifices. This style is suggested as a replacement for Style 363.



Style 373 & 394M - Straight Bore

High Speed High Quality Cutting Material Thickness	Size	High Production Cutting Material Thickness	NATURAL GAS & PROPANE		
			Style 373 Assembly No.	Style 373 Shell No.	Style 373 Insert No.
5/16″	0	1/2″	813-3730	813-2116	813-2150
1/2″	1	1″	813-3731	813-2116	813-2133
1-1/4″	2	1-1/2″	813-3732	813-2116	813-2134
2	3	3″	813-3733	813-2116	813-2135
3	4	6″	813-3734	813-2116	813-2136
5″	5	7″	813-3735	813-2116	813-2137
–	7	8″	813-3737	813-2118	813-2138
–	8	12″	813-3738	813-2118	813-2139
–	10	16″	813-3739	813-2118	813-2140

Style 394M Divergent Tips

The Style 394M MAPP Gas tip is a two piece design with thin rectangular splines. It can be used for high speed, high quality cutting and high production cutting. Sizes 0 through 5 have divergent cutting oxygen orifices. Sizes 7, 8, and 10 have straight bore cutting oxygen orifices. This style is suggested as a replacement for Style 364.

High Production Cutting Material Thickness	Size	High Speed High Quality Cutting Material Thickness	MAPP GAS		
			Style 394M Assembly No.	Style 394M Shell No.	Style 394M Insert No.
5/16″	0	1/2″	813-3940	813-2117	813-2141
1/2″	1	1″	813-3941	813-2117	813-2142
1-1/4″	2	1-1/2″	813-3942	813-2117	813-2143
2″	3	3″	813-3943	813-2117	813-2144
3″	4	6″	813-3944	813-2117	813-2145
5″	5	7″	813-3945	813-2117	813-2146
–	7	8″	813-3947	813-2119	813-2147
–	8	12″	813-3948	813-2119	813-2148
–	10	16″	813-3949	813-2119	813-2149

813-2111 seal and 813-2115 sleeve are required for each tip. These parts are included in the assembly.
As a replacement part 813-2111 seal in package of 10 ea. order 813-2151, in package of 100 ea. order 813-2152.
813-2115 sleeve in package of 10 ea. order 813-2153, in package of 100 ea. order 813-2154.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Natural Gas

Use Low Pressure Injector 831-2904

MASTER TIPS Style 373 — Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Nat. Gas		Oxygen		Nat. Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
⅛	00*	813-2799	22	20	12	-	-	-	-	15	30	3 oz	20	.025	.05
3/16			22	25	15	-	-	-	-	20	40	3 oz	25		
¼	0	813-3730	21	90	70	-	-	-	-	20	40	3 oz	25	.031	.06
⅜			20	95	75	40	74	3 oz	37	25	50	3 oz	35		
½			19	100	78	50	90	3 oz	45	25	50	3 oz	35		
¾	1	813-3731	17	100	120	50	90	3 oz	45	25	50	3 oz	35	.036	.07
1			17	105	126	50	90	3 oz	45	25	50	3 oz	35		
1¼	2	813-3732	16	90	180	50	90	3 oz	45	30	59	3 oz	40	.046	.09
1½			15	105	206	50	90	3 oz	45	30	59	3 oz	40		
2	3	813-3733	12	95	268	50	90	3 oz	45	30	59	3 oz	40	.055	.11
2½			11	100	284	50	90	3 oz	45	30	59	3 oz	40		
3	4	813-3734	9	85	323	50	90	3 oz	45	35	66	3 oz	40	.063	.12
4			8	90	340	50	90	3 oz	45	35	66	3 oz	40		
5	5	813-3735	7	85	426	50	90	3 oz	45	35	66	3 oz	40	.073	.14
6			6-7	90	450	50	90	3 oz	45	35	66	3 oz	40		
8	7	813-3736	5	90	630	55	102	3 oz	88	-	-	-	-	.099	.20
10	8	813-3737	5	95	760	55	102	3 oz	88	-	-	-	-	.125	.25
12			4	105	850	55	102	3 oz	88	-	-	-	-		
14	10	813-3739	3	110	900	55	102	3 oz	88	-	-	-	-	.169	.34
16			3	120	1100	55	102	3 oz	88	-	-	-	-		

*Size 00 is of style 273

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Natural Gas

Use Positive Pressure Mixer Adapter 831-2873

MASTER TIPS Style 373 — Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Nat. Gas		Oxygen		Nat. Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
⅛	00*	813-2799	22	20	12	-	-	-	-	4	30	3	20	.025	.05
3/16			22	25	15	-	-	-	-	4	40	3	25		
¼	0	813-3730	21	90	70	-	-	-	-	4	40	3	25	.031	.06
⅜			20	95	75	9	74	4	37	5	50	4	35		
½			19	100	78	12	90	6	45	5	50	4	35		
¾	1	813-3731	17	100	120	12	90	6	45	5	50	4	35	.036	.07
1			17	105	126	12	90	6	45	5	50	4	35		
1¼	2	813-3732	16	90	180	12	90	6	45	6	59	5	40	.046	.09
1½			15	105	206	12	90	6	45	6	59	5	40		
2	3	813-3733	12	95	268	12	90	6	45	6	59	5	40	.055	.11
2½			11	100	284	12	90	6	45	6	59	5	40		
3	4	813-3734	9	85	323	12	90	6	45	6	66	5	40	.063	.12
4			8	90	340	12	90	6	45	6	66	5	40		
5	5	813-3735	7	85	426	12	90	6	45	6	66	5	40	.073	.14
6			6-7	90	450	12	90	6	45	6	66	5	40		
8	7	813-3737	5	90	630	30	175	10	112	-	-	-	-	.099	.20
10	8	813-3738	5	95	760	30	175	10	112	-	-	-	-	.125	.25
12			4	105	850	35	160	13.5	146	-	-	-	-		
14	10	813-3739	3	110	900	35	160	13.5	146	-	-	-	-	.169	.34
16			3	120	1100	35	160	13.5	146	-	-	-	-		

*Size 00 is of style 273

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Propane

Use Low Pressure Injector 831-2904

MASTER TIPS Style 373 — Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Propane		Oxygen		Propane			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
1/8	00*	813-2799	22	20	12	-	-	-	-	15	35	3 oz	10	.025	.05
3/16			22	25	15	-	-	-	-	15	35	3 oz	10		
1/4	0	813-3730	21	90	70	-	-	-	-	20	40	3 oz	12	.031	.06
3/8			20	95	75	35	65	3 oz	16	25	50	3 oz	15		
1/2			19	100	78	50	90	3 oz	22	25	50	3 oz	15		
3/4	1	813-3731	17	100	120	50	90	3 oz	22	25	50	3 oz	15	.036	.07
1			17	105	126	50	90	3 oz	22	25	50	3 oz	15		
1 1/4	2	813-3732	16	90	180	50	90	3 oz	22	30	59	3 oz	17	.046	.09
1 1/2			15	105	206	50	90	3 oz	22	30	59	3 oz	17		
2	3	813-3733	12	95	268	50	90	3 oz	22	30	59	3 oz	17	.055	.11
2 1/2			11	100	284	50	90	3 oz	22	30	59	3 oz	17		
3	4	813-3734	9	85	323	50	90	3 oz	22	35	64	3 oz	19	.063	.12
4			8	90	340	50	90	3 oz	22	35	64	3 oz	19		
5	5	813-3735	7	85	426	50	90	3 oz	22	35	64	3 oz	19	.073	.14
6			6-7	90	450	50	102	3 oz	22	35	64	3 oz	19		
8	7	813-3736	5	90	630	55	102	3 oz	53	-	-	-	-	.099	.20
10	8	813-3737	5	95	760	55	102	3 oz	53	-	-	-	-	.125	.25
12			4	105	850	55	102	3 oz	53	-	-	-	-		
14	10	813-3739	3	110	900	55	102	3 oz	53	-	-	-	-	.169	.34
16			3	120	1100	55	103	3 oz	53	-	-	-	-		

*Size 00 is of style 273

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Propane

Use Positive Pressure Mixer Adapter 831-2873

MASTER TIPS Style 373 — Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Propane		Oxygen		Propane			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
1/8	00*	813-2799	22	20	12	-	-	-	-	4	35	2	10	.025	.05
3/16			22	25	15	-	-	-	-	4	35	2	10		
1/4	0	813-3730	21	90	70	-	-	-	-	5	40	3	12	.031	.06
3/8			20	95	75	7	65	5	16	6	50	4	15		
1/2			19	100	78	10	90	6	22	6	50	4	15		
3/4	1	813-3731	17	100	120	10	90	6	22	6	50	4	15	.036	.07
1			17	105	126	10	90	6	22	6	50	4	15		
1 1/4	2	813-3732	16	90	180	10	90	6	22	6	59	4	17	.046	.09
1 1/2			15	105	206	10	90	6	22	6	59	4	17		
2	3	813-3733	12	95	268	10	90	6	22	6	59	4	17	.055	.11
2 1/2			11	100	284	10	90	6	22	6	59	4	17		
3	4	813-3734	9	85	323	10	90	6	22	7	64	5	19	.063	.12
4			8	90	340	10	90	6	22	7	64	5	19		
5	5	813-3735	7	85	426	10	90	6	22	7	64	5	19	.073	.14
6			6-7	90	450	10	90	6	22	7	64	5	19		
8	7	813-3737	5	90	630	22	175	8	60	-	-	-	-	.099	.20
10	8	813-3738	5	95	760	22	175	8	60	-	-	-	-	125	.25
12			4	105	850	40	250	12	81	-	-	-	-		
14	10	813-3739	3	110	900	40	250	12	81	-	-	-	-	169	.34
16			3	120	1100	40	250	12	81						

*Size 00 is of style 273

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Natural Gas

Use Low pressure injector 831-2904

MASTER TIPS Style 373 — Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Nat. Gas		Oxygen		Nat. Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3730	18-24	70	35	-	-	-	-	20	40	3oz	25	.031	.06
5⁄16			18-24	75	40	-	-	-	-	20	40	3oz	25		
⅜	1	813-3731	20-22	70	85	40	74	3oz	37	25	50	3oz	25	.036	.07
½			22-25	75	92	50	90	3oz	45	25	50	3oz	35		
¾	2	813-3732	21-24	80	160	50	90	3oz	45	25	50	3oz	35	.046	.09
1			19-22	85	170	50	90	3oz	45	25	50	3oz	35		
1¼			17-20	90	180	50	90	3oz	45	30	59	3oz	40		
1½	3	813-3733	15-17	75	216	50	90	3oz	45	30	59	3oz	40	.055	.11
2			14-16	85	243	50	90	3oz	45	30	59	3oz	40		
2½	4	813-3734	13-15	85	323	50	90	3oz	45	30	59	3oz	40	.063	.12
3			12-14	100	378	50	90	3oz	45	35	66	3oz	40		
4	5	813-3735	10-11	85	426	50	90	3oz	45	35	66	3oz	40	.073	.14
5			8-9	95	475	50	90	3oz	45	35	66	3oz	40		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Natural Gas

Use Positive Pressure Mixer Adapter 831-2873

MASTER TIPS Style 373 — Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Nat. Gas		Oxygen		Nat. Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3730	18-24	70	35	-	-	-	-	4	40	3	25	.031	.06
5⁄16			18-24	75	40	-	-	-	-	4	40	3	25		
⅜	1	813-3731	20-22	70	85	9	74	4	37	5	50	4	35	.036	.07
½			22-25	75	92	12	90	6	45	5	50	4	35		
¾	2	813-3732	21-24	80	160	12	90	6	45	5	50	4	35	.046	.09
1			19-22	85	170	12	90	6	45	5	50	4	35		
1¼			17-20	90	180	12	90	6	45	6	59	5	40		
1½	3	813-3733	15-17	75	216	12	90	6	45	6	59	5	40	.055	.11
2			14-16	85	243	12	90	6	45	6	59	5	40		
2½	4	813-3734	13-15	85	323	12	90	6	45	6	59	5	40	.063	.12
3			12-14	100	378	12	90	6	45	6	66	5	40		
4	5	813-3735	10-11	85	426	12	90	6	45	6	66	5	40	.073	.14
5			8-9	95	475	12	90	6	45	6	66	5	40		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Propane Gas

Use Low pressure injector 831-2904

MASTER TIPS Style 373 — Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Propane		Oxygen		Propane			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3730	18-24	70	35	-	-	-	-	20	40	3oz	12	.031	.06
5/16			18-24	75	40	-	-	-	-	25	50	3oz	15		
⅜	1	813-3731	20-22	70	85	35	65	3oz	16	25	50	3oz	15	.036	.07
½			22-25	75	92	50	90	3oz	23	25	50	3oz	15		
¾	2	813-3732	21-24	80	160	50	90	3oz	23	25	50	3oz	15	.046	.09
1			19-22	85	170	50	90	3oz	23	25	50	3oz	17		
1¼			17-20	90	180	50	90	3oz	23	30	59	3oz	17		
1½	3	813-3733	15-17	75	216	50	90	3oz	23	30	59	3oz	17	.055	.11
2			14-16	85	243	50	90	3oz	23	30	59	3oz	17		
2½	4	813-3734	13-15	85	323	50	90	3oz	23	30	59	3oz	17	.063	.12
3			12-14	100	378	50	90	3oz	23	35	64	3oz	19		
4	5	813-3735	10-11	85	426	50	90	3oz	23	35	64	3oz	19	.073	.14
5			8-9	95	475	50	90	3oz	23	35	64	3oz	19		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Propane

Use Positive Pressure Mixer Adapter 831-2873

MASTER TIPS Style 373 — Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Propane		Oxygen		Propane			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3730	18-24	70	35	-	-	-	-	5	40	3	12	.031	.06
5/16			18-24	75	40	-	-	-	-	5	40	3	12		
⅜	1	813-3731	20-22	70	85	7	65	5	16	6	50	4	15	.036	.07
½			22-25	75	92	10	90	6	23	6	50	4	15		
¾	2	813-3732	21-24	80	160	10	90	6	23	6	50	4	15	.046	.09
1			19-22	85	170	10	90	6	23	6	50	4	15		
1¼			17-20	90	180	10	90	6	23	6	59	4	17		
1½	3	813-3733	15-17	75	216	10	90	6	23	6	59	4	17	.055	.11
2			14-16	85	243	10	90	6	23	6	59	4	17		
2½	4	813-3734	13-15	85	323	10	90	6	23	6	59	4	17	.063	.12
3			12-14	100	378	10	90	6	23	7	64	5	19		
4	5	813-3735	10-11	85	426	10	90	6	23	7	64	5	19	.073	.14
5			8-9	95	475	10	90	6	23	7	64	5	19		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Mapp Gas

Use Low pressure injector 831-2904

MASTER TIPS Style 394M— Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Mapp Gas		Oxygen		Mapp Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3940	18-24	70	35	-	-	-	-	7	14	3oz	7	.031	.06
5/16			18-24	75	40	-	-	-	-	7	14	3oz	7		
⅜	1	813-3941	20-22	70	85	26	50	3oz	14	8	20	3oz	10	.036	.07
½			22-25	75	92	26	50	3oz	14	8	20	3oz	10		
¾	2	813-3942	21-24	80	160	26	50	3oz	14	8	20	3oz	10	.046	.09
1			19-22	85	170	26	50	3oz	14	8	20	3oz	10		
1¼			17-20	90	180	26	50	3oz	14	8	20	3oz	10		
1½	3	813-3943	15-17	75	216	26	50	3oz	14	8	20	3oz	10	.055	.11
2			14-16	85	243	26	50	3oz	14	8	20	3oz	10		
2½	4	813-3944	13-15	85	323	26	50	3oz	14	12	24	3oz	12	.063	.12
3			12-14	100	378	34	60	3oz	17	12	24	3oz	12		
4	5	813-3945	10-11	85	426	34	60	3oz	17	12	24	3oz	12	.073	.14
5			8-9	95	475	34	60	3oz	17	12	24	3oz	12		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Mapp Gas

Use Positive Mixer Adapter 831-2873

MASTER TIPS Style 394M — Chart for High Production Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		Mapp Gas		Oxygen		Mapp Gas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
¼	0	813-3940	18-24	70	35	-	-	-	-	2	14	2	7	.031	.06
5/16			18-24	75	40	-	-	-	-	2	14	2	7		
⅜	1	813-3941	20-22	70	85	5	50	2	14	3	20	2	10	.036	.07
½			22-25	75	92	5	50	2	14	3	20	2	10		
¾	2	813-3942	21-24	80	160	5	50	2	14	3	20	2	10	.046	.09
1			19-22	85	170	5	50	2	14	3	20	2	10		
1¼			17-20	90	180	5	50	2	14	3	20	2	10		
1½	3	813-3943	15-17	75	216	5	50	2	14	3	20	2	10	.055	.11
2			14-16	85	243	5	50	2	14	3	20	2	10		
2½	4	813-3944	13-15	85	323	5	50	2	14	3	24	3	12	.063	.12
3			12-14	100	378	7	60	3	17	3	24	3	12		
4	5	813-3945	10-11	85	426	7	60	3	17	3	24	3	12	.073	.14
5			8-9	95	475	7	60	3	17	3	24	3	12		

High Production cutting yield face cut of reasonable quality which is acceptable in most of the steel fabrication industry.

On an hourly basis more oxygen is used with High Production cutting than with conventional High Speed, High Quality Cutting. However, due to the higher cutting speeds utilized, cutting time is shortened, oxygen consumption is nearly equal for the same cut, and there is a net savings in labor.

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Low Pressure Mapp Gas

Use Low Pressure Injector 831-2904

MASTER TIPS Style 394M—Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		MappGas		Oxygen		MappGas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
⅛	00*	813-2799	22	20	12	-	-	-	-	5	10	3oz	5	.025	.05
3/16			22	25	15	-	-	-	-	5	10	3oz	5		
¼	0	813-3940	21	90	70	-	-	-	-	7	14	3oz	7	.031	.06
⅜			20	95	75	26	50	3oz	14	8	20	3oz	10		
½			19	100	78	26	50	3oz	14	8	20	3oz	10		
¾	1	813-3941	17	100	120	26	50	3oz	14	8	20	3oz	10	.036	.07
1			17	105	126	26	50	3oz	14	8	20	3oz	10		
1¼	2	813-3942	16	90	180	26	50	3oz	14	8	20	3oz	10	.046	.09
1½			15	105	206	26	50	3oz	14	8	20	3oz	10		
2	3	813-3943	12	95	268	26	50	3oz	14	8	20	3oz	10	.055	.11
2½			11	100	284	26	50	3oz	14	12	24	3oz	12		
3	4	813-3944	9	85	323	34	60	3oz	17	12	24	3oz	12	.063	.12
4			8	90	340	34	60	3oz	17	12	24	3oz	12		
5	5	813-3945	7	85	426	34	60	3oz	17	12	24	3oz	12	.073	.14
6			6-7	90	450	34	60	3oz	17	12	24	3oz	12		
8	7	813-3947	5	90	630	50	92	3oz	42	-	-	-	-	.099	.20
10	8	813-3948	5	95	760	50	92	3oz	42	-	-	-	-	.125	.25
12			4	105	850	50	92	3oz	42	-	-	-	-		
14	10	813-3949	3	110	900	50	92	3oz	42	-	-	-	-	.169	.34
16			3	120	1100	50	92	3oz	42	-	-	-	-		

*Size 00 is of style 273M

Approximate Machine Cutting Guide for style 4700 Cutting Torch

Positive Pressure Mapp Gas

Use Positive Pressure Mixer Adapter 831-2873

MASTER TIPS Style 394M—Chart for High Speed & High Quality Cut

Mtl. Thick in.	Cutting Tip		Cutting Speed Inches Per Minute	Cutting Oxygen		Preheat Pressure & Flows								Cutting Port Drill Size	Kerf Width In.
						High				Low					
						Oxygen		MappGas		Oxygen		MappGas			
	Tip Size	Stock Number		PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH	PSI	CFH		
⅛	00*	813-2799	22	20	12	-	-	-	-	2	10	2	5	.025	.05
3/16			22	25	15	-	-	-	-	2	10	2	5		
¼	0	813-3940	21	90	70	-	-	-	-	2	14	2	7	.031	.06
⅜			20	95	75	5	50	2	14	3	20	2	10		
½			19	100	78	5	50	2	14	3	20	2	10		
¾	1	813-3941	17	100	120	5	50	2	14	3	20	2	10	.036	.07
1			17	105	126	5	50	2	14	3	20	2	10		
1¼	2	813-3942	16	90	180	5	50	2	14	3	20	2	10	.046	.09
1½			15	105	206	5	50	2	14	3	20	2	10		
2	3	813-3943	12	95	268	5	50	2	14	3	20	2	10	.055	.11
2½			11	100	284	5	50	2	14	3	24	3	12		
3	4	813-3944	9	85	323	7	60	3	17	3	24	3	12	.063	.12
4			8	90	340	7	60	3	17	3	24	3	12		
5	5	813-3945	7	85	426	7	60	3	17	3	24	3	12	.073	.14
6			6-7	90	450	7	60	3	17	3	24	3	12		
8	7	813-3947	5	90	630	23	183	12	50	3	24	3	12	.099	.20
10	8	813-3948	5	95	760	23	183	12	50	-	-	-	-	.125	.25
12			4	105	850	23	183	12	50	-	-	-	-		
14	10	813-3949	3	110	900	23	183	12	50	-	-	-	-	.169	.34
16			3	120	1100	23	183	12	50	-	-	-	-		

*Size 00 is of style 273M Substitute the long shell by a short shell 813-2117

SUMMARY CHART
MASTER TIPS
PROPANE, NATURAL GAS & MAPP® TIPS

COMPACT SEAT BLOCKS MUST BE USED WITH MASTER CUTTING TIPS.
ONLY ONE BLOCK IS REQUIRED PER TORCH.

APPLICATIONS	TORCHES	BORE TYPE	STYLES
GENERAL PURPOSE	AIRCO, HARRIS, SMITH, VICTOR	STRAIGHT	273, 273M 294, 294M
MACHINE CUTTING	AIRCO, HARRIS, SMITH, VICTOR	DIVERGENT	373, 373M 394M

8. TIP MAINTENANCE

One of the most important elements in the oxy-fuel process is a clean tip. A clean tip gives a clean cut; it is easier to properly adjust the flame; it delivers the heat better and where it is needed. The condition and the maintenance of cutting tips are important factors in the quality of work as well as the efficiency and economy of the operation. Frequent cleaning of a burning tip extends its life two or three times and decreases work rejects.

There are various ways of insuring that cutting tips are well maintained. One is to have two sets of tips per machine. A used set could be turned in at the end of the week to the Maintenance Shop or Tool Room and a clean set issued the next work day.

CARE (Fig. G-11a & 11b)

Never use a tip as a hammer face to remove slag; use a chipping hammer or similar tool (Fig. G-11a). Keep the preheat flame cones just above the work surface to protect tip orifices from molten slag (Fig. G-11b).

Handle and store tips carefully to avoid damage to edges, orifices, and sealing surfaces. Damaged edges or orifices spoil cutting quality; they cause lost cuts or gouged cutfaces. Damaged sealing surfaces cause leaks and resulting fire hazards.

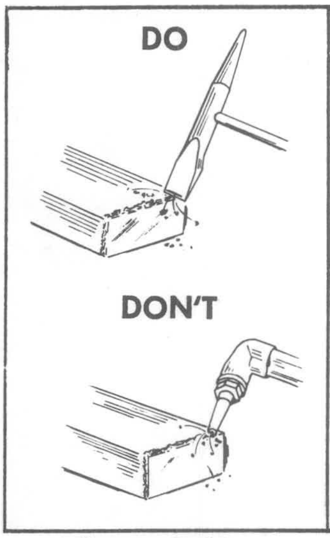


Figure G-11a
TIP ABUSE

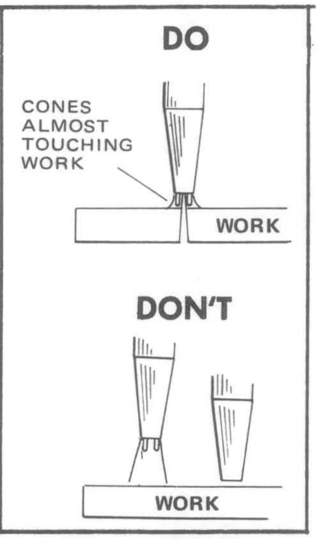


Figure G-11b
TIP-TO-WORK HEIGHT

CHECKING AND CLEANING

To get a quality cut, the tip must be clean. Before cutting, with the preheat flame burning, observe the cutting oxygen stream (Fig. G-12a). If the tip is clean, the stream will be sharply defined, in a long, straight-line exit from the tip. If the stream is fuzzy, short, or off-center, the tip must be cleaned. If it can not be cleaned, discard it.

AIRCO Tip Cleaners if used are designed to remove foreign matter without damage to the tip if used properly. Tip Cleaner Sets are listed in Catalog Sheet 833. USE ONLY the tip cleaner designed for the specific tip. NEVER use any other device. USE ONLY an up and down motion with a cleaner (Fig. G-12b) or drill; NEVER rotate or wiggle rod or drill.

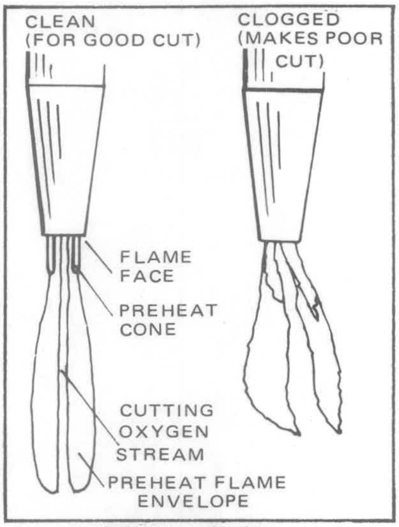


Figure G-12a
FLAME APPEARANCE

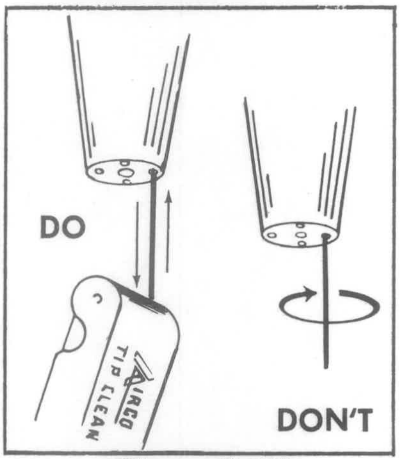


Figure G-12b
UP AND DOWN CLEANING MOTION

STRAIGHT-BORE TIP

Clean with Tip Cleaner Set:

a. Use file in set to remove all foreign particles from flame face of tip.
b. Choose cleaner according to drill number of cutting oxygen or preheat hole and insert in hole exit. Where possible, remove tip from torch and insert cleaner from a LONG Cleaner Set through inlet end.
c. With tip pointing down to let slag drop out, use up and down motion, allowing cleaner to float freely; do not rotate or wiggle cleaner.
d. Avoid belling out the hole opening.
e. If slag build-up is excessive, start with smaller cleaner and work up to proper size.

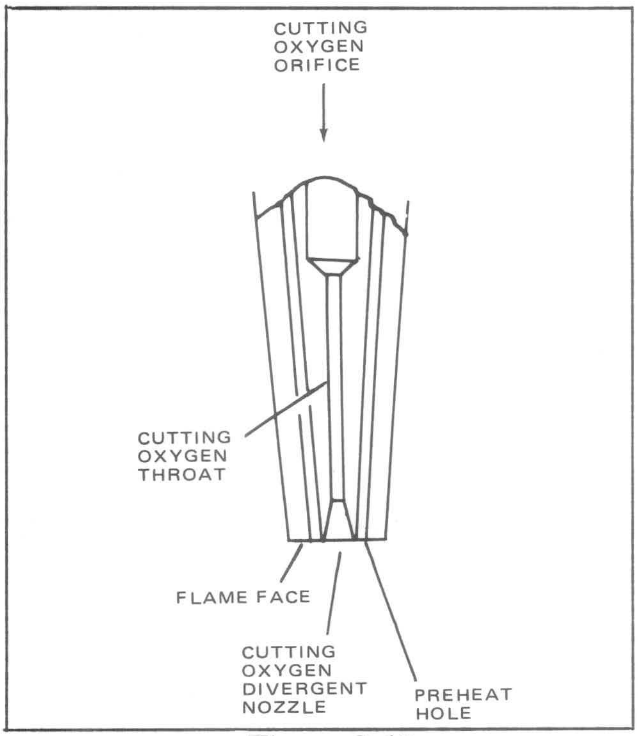


Figure G-13
ONE-PIECE DIVERGENT TIP

DIVERGENT TIP

The divergent tip orifice (Fig. G-13) for cutting oxygen is precision-drilled and machined for quality machine cutting. To preserve it:

a. Clean cutting oxygen throat with matching size smooth cleaning rod; NEVER use a drill or preheat-hole cleaning-rod tip cleaner.
b. Clean exit of cutting oxygen nozzle with a FIBRE cleaner (stock no. 832-3420) ONLY. Never use a metal device that may chamfer the nozzle exit; exit must have sharp edge.
c. Clean preheat holes with matching size cleaning drill in up and down motion; do not rotate or wriggle tool.

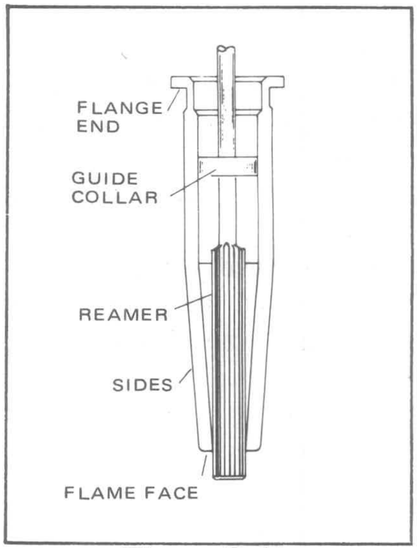


Figure G-14a
TWO-PIECE DIVERGENT TIP

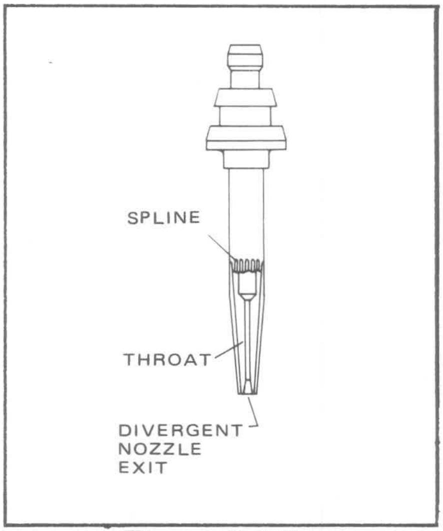


Figure G-14b
TWO-PIECE DIVERGENT TIP

TWO-PIECE TIP

Clean each part of a two-piece tip separately (Fig. G-14a & 14-b) in tool crib:

Shell

a. Brighten (sides only) with hand or power wire brush.
b. Clean bore with soft, round, nylon brush. Remove stubborn slag from shell bore with .213 reamer for tip sizes 1 to 4 use .266 for tip sizes 5 and 7. Use .440-inch

O.D. guide collar on reamer, and ream from flange end.

c. Do NOT remove metal or scrape bore with reamer or any other device. Do NOT sand or file the flame end.

Insert

a. Clean divergent nozzle exit and throat of cutting oxygen hole (for throat, use Jumbo cleaner set, stock no. 832-4598).
b. Clean spline with brass wire brush (stock no. 833-4906).
c. Replace worn or damaged O-rings (if any).
d. Do NOT remove metal from insert with reamer or any other device. DO NOT sand or file the nozzle face or the sealing surfaces.

DIVERGENT

When a divergent tip has been cut back at the flame face; the divergent nozzle area loses its efficiency. To re-form this area, if it has been affected by cut back or other damage, an AIRCO Tapered Reamer must be used. Do NOT use any other device, or use the reamer beyond a 1/4-inch cutback. Choose the proper size reamer, stock nos. 832-3450 to 3460, for tips numbered 0 to 10 respectively. DO NOT cut back a tip with a short throat such as Style 361, Size 0; it can not be re-formed.

LESSON PLAN

SUBJECT: SECTION H: WELDING AND CUTTING OUTFITS

OBJECTIVE:

1. To present the four popular Airco welding and cutting outfits, their characteristics, and performance.
2. To make comparisons with competition by describing their equipment characteristics and indicate the shortcomings.
3. Explain how the characteristics of the Airco equipment helps a customer.

REFERENCE: Product Information Class 8 Text

Section H: Welding and Cutting Outfits.

TRAINING MATERIALS: Section H: Welding and Cutting Outfits

Applied Exercise

Supplementary Material Airco Outfits Brochure ADC-2000

PRESENTATION:
SEE BROCHURE ON AIRCO OUTFITS IN SUPPLEMENTARY MATERIALS. LOOK AT SUPER AIRCOMASTER AS YOU GO THROUGH THE CONTENTS OF AN OUTFIT.

I. WELDING AND CUTTING OUTFITS

A. Ready-made packages make it easy to serve a customer's needs.

B. Outfits Consist of:

1. Oxygen regulator
2. Acetylene regulator
3. Torch handle
4. Mixer
5. Selection of welding tips (or a selection of mixer and welding tip assemblies)
6. Heating tip
7. Cutting attachment
8. Cutting tip
9. Length of hose
10. Goggles
11. Sparklighter
    a. In some instances, the accessories; such as, goggles, sparklighter and hose may be omitted.

C. Reasons for outfits

1. Pre-selected welding and cutting outfits were a direct outcome of users who wanted to have, at their fingertips, all the necessary equipment to do welding and cutting and for convenience of Distributor sales.
2. With the addition of a cutting attachment to the welding torch, there is a quicker way to go from welding to cutting.

REFER TO ABOVE BROCHURE ADC-2000 ON OUTFITS IN SUPPLEMENTARY MATERIALS.

D. The Airco outfits —

SUPER AIRCOMASTER® (SAM)
AIRCOMASTER®
AIRCOMITE® B
AIRCOMITE®

1. SUPER AIRCOMASTER — finest outfit on the market. It has no competitor. Only Airco has this outfit.
2. AIRCOMASTER—is designed to satisfy the largest range of conditions and is used for light to heavy work. It is Airco's most popular outfit.
3. AIRCOMITE—designed for almost the same work range as the AIRCOMASTER, but can also do delicate work.

SEE AD REPRINT, "NOW YOU KNOW HOW TO BUY A BETTER OUTFIT" SUPPLEMENTARY MATERIALS.

SEE THE CHART ON AIRCO OUTFITS VERSUS COMPETITION IN SECTION H: WELDING AND CUTTING OUTFITS

4. AIRCOMITE B—is a modified version of AIRCOMITE.

E. Comparisons with competition
   1. There is a detailed comparison with competition's outfits in the text material of this section. However, the most important items were summarized into a chart which illustrate the primary features and benefits of the Airco regulators, torches, and cutting attachments that are contained in the Airco outfits with competitions', features and shortcomings.
      a. SUPER AIRCOMASTER Outfit (SAM)
         1. Since the SUPER AIRCOMASTER has no equal in the marketplace, no competitive comparisons can be made. Therefore, SAM does not appear on the chart.
         2. The SUPER AIRCOMASTER contains:
            a. The two-stage regulator style 8400, that as previously learned, delivers gas flows at constant pressure —no resetting of torch valves. (no competitor includes a two-stage regulator in their outfits.)
            b. The highest capacity welding and heating torch style 800.
            c. Cutting attachment style 4800, permits cutting in excess of 8" thick steel.
            d. Universal size #10 heating tip can deliver high BTU output with any fuel.
            e. Tables H-1 and H-2 contain specific detail flow data on torch handles, cutting attachments and regulators. This data should be used in conjunction with the text material, "5. Comparisons with Competition."

AIRCO OUTFITS VERSUS COMPETITION

AIRCOMASTER

AIRCO		COMPETITION	
FEATURES	BENEFITS	FEATURES	SHORTCOMINGS
REGULATOR—STYLE 9100		**VICTOR JOURNEY MAN REGULATOR—STYLE SR400**	
Neoprene diaphragm is more sensitive to pressure changes.	More constant delivery pressure	Stainless steel diaphragm less sensitive to pressure changes	Greater pressure change in use, requires adjustment more often
TORCH HANDLE—STYLE 750		**TORCH HANDLE—STYLE 315**	
Corn cob grip	Non-slip	Smooth, lightly ribbed grip	More slip
Dual gas tubes silver brazed	Maximum safety from leakage and explosion	Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE 4700		**CUTTING ATTACHMENT—STYLE CA1050**	
Tip mixing	Flame stability—no flashback, use any gas.	Premixing	Change attachment or mixer depending on gas or thickness of material.
Stainless head and tubes	Minimum maintenance and durable	Bronze head and stainless tubes	More frequent maintenance; less durable.

COMPETITION		COMPETITION	
FEATURES	SHORTCOMING	FEATURES	SHORTCOMINGS
REGULATOR STYLE 94 HARRIS — MASTER		**SMITH — STAR 98 REGULATOR — STYLE H1520**	
Diaphragm used as relief valve	Diaphragm bursts if regulator is overpressurized, and needs to be replaced. Does not have a safety relief valve.	Buna-N diaphragm plus diaphragm bearing plate	Reduced sensitivity of diaphragm due to bearing plate; results in greater pressure change in use. Requires adjustment more often.
TORCH HANDLE—STYLE 43-2F		**TORCH HANDLE—STYLE SW1**	
Smooth, lightly ribbed grip	More slip	Smooth, ribbed grip	More slip
Inner gas tube, and outer gas tube (handle) sealed by O-rings	More prone to leakage and explosion	Inner and outer tubes brazed; inner tube blind joints; outer tube is the grip (handle)	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE 73		**CUTTING ATTACHMENT—STYLE SC209**	
Injector mixing	Change attachment or mixer depending on gas or thickness of material. Limited preheat gas flow. Sensitive flame stability.	Tip mixing Slip-in design has O-rings exposed	Flame stability is good, but exposed O-rings on slip-in design, easily damaged.
Brass head	More frequent maintenance, less durable	Brass head	More frequent maintenance, less durable

AIRCO OUTFITS VERSUS COMPETITION

AIRCOMITE AND AIRCOMITE B

AIRCO	
FEATURES	**BENEFIT**
TORCH HANDLE—STYLE 750	
Corn cob grip	Non-slip
Dual gas tubes silver brazed	Maximum safety from leakage and explosion.
CUTTING ATTACHMENT—STYLE 3700	
Tip mixing	Flame stability—no flashback; use any gas.

COMPETITION	
FEATURES	**SHORTCOMING**
VICTOR-SUPER RANGE: TORCH HANDLE—STYLE 100	
Smooth, lightly ribbed grip	More slip
Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and
CUTTING ATTACHMENT—STYLE CA1350	
Premixing	Change attachment or mixer depending on gas or thickness of material.

COMPETITION	
FEATURES	**SHORTCOMINGS**
HARRIS EXPERT: TORCH HANDLE — STYLE 85F	
Staked (rivet-like) fasteners on outer handle.	Makes it very impractical to repair. Has limited flow.
CUTTING ATTACHMENT—STYLE 72	
Injector mixing	Change attachment or mixer depending on gas or thickness of material.

COMPETITION	
FEATURES	**SHORTCOMING**
SMITH — BIG 98: TORCH HANDLE — STYLE MW5	
Smooth, lightly ribbed grip	More slip
Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE MC509	
Tip Mixing Slip-in design has O-rings exposed	Flame stability is good, but exposed O-rings on stip-in design, easily damaged.

APPLIED EXERCISE:

AIRCO OUTFITS COMPARISONS WITH COMPETITION

Given the AIRCO feature, place the appropriate benefit in the column marked BENEFIT. Given the competitive feature, place the appropriate short coming in the column marked SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	FEATURE	SHORTCOMING	FEATURE
AIRCOMASTER Regulator-Style 9100		VICTOR—JOURNEYMAN Regulator-Style SR400	
	Neoprene diaphragm		Stainless steel diaphragm
Torch Handle-Style 750		Torch Handle-Style 315	
	Dual gas tubes silver brazed		Inner gas tube, mechanical joint, outer gas tube is the grip.
Cutting Attachment-Style 4700		Cutting Attachment-Style CA1050	
	Tip Mixing		Premixing

COMPETITION		COMPETITION	
SHORTCOMING	FEATURE	SHORTCOMING	FEATURE
HARRIS—MASTER Regulator-Style 94		SMITH—STAR 98 Regulator-Style H1520	
	Diaphragm used as relief valve		Buna-N diaphragm plus diaphragm bearing plate
Torch Handle-Style 43-2F		Torch Handle-Style SW1	
	Inner gas tube, and outer gas tube handle sealed by O-rings		Inner and outer tube brazed; outer tube blind joints
Cutting Attachment-Style 73		Cutting Attachment-Style SC209	
	Injector mixing		Exposed O-rings on slip-in design

APPLIED EXERCISE (Continued)

AIRCO OUTFITS COMPARISONS WITH COMPETITION

AIRCO		COMPETITION	
BENEFIT	FEATURE	SHORTCOMING	FEATURE
AIRCOMITE AND AIRCOMITE B		VICTOR—SUPER RANGE	
Torch Handle-Style 750		Torch Handle-Style 100	
	Dual gas tubes silver brazed		Inner gas tube, mechanical joint, outer gas tube is the grip.
Cutting Attachment-Style 3700		Cutting Attachment-Style CA1350	
	Tip mixing		Premixing

COMPETITION		COMPETITION	
SHORTCOMING	FEATURE	SHORTCOMING	FEATURE
HARRIS—EXPERT Torch Handle-Style 85F		SMITH—BIG 98 Torch Handle-Style MW5	
	Staked (rivet like) fasteners on outer handle		Inner gas tube, mechanical joint, outer gas tube is the grip
Cutting Attachment-Style 72		Cutting Attachment - Style MC509	
	Injector mixing		Exposed O-rings on slip-in design

Check your answers on preceding pages H4, H5

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION H
WELDING AND CUTTING OUTFITS

1. Introduction

2. Contents of Outfits

3. Reason for Outfits

4. The Airco Outfits
   a. SUPER AIRCOMASTER®
   b. AIRCOMASTER®
   c. AIRCOMITE® B
   d. AIRCOMITE®

5. Comparison with Competition

1. INTRODUCTION

If a customer were to ask you for equipment to do oxy-fuel welding and cutting, where would you begin to find the proper equipment?

You would have to select each item from a catalog, until you find each and every part.

Now wouldn't it be handy to go to a package and say, here is the equipment you need?

Airco has done it.

We have reviewed all of the varieties of oxy-fuel items to determine exactly what is needed, and have come up with basic packaged outfits that handle the light, medium and heavy jobs.

2. CONTENTS OF OUTFITS

A Welding and Cutting outfit includes the following items:

- Oxygen regulator
- Acetylene regulator
- Torch handle
- Mixer
- Selection of welding tips or a selection of mixer and welding tip assemblies
- Heating tip
- Cutting attachment
- Length of hose
- Goggles
- Sparklighter

In some instances the accessories, such as, goggles, sparklighter, and hose may be omitted.

3. REASONS FOR OUTFITS

Pre-selected welding and cutting outfits were a direct outcome of users who wanted to have, at their fingertips, all of the equipment necessary to do welding and cutting.

Originally, outfits were put together to do welding only. When a weldor had to weld steel, heat it, bend it or work it, this outfit was handy. However, to cut metal, the operator had to have, on hand, another set of cylinders, regulators and a cutting torch. Or, the operator would have to detach the welding torch and install the cutting torch. This would mean that the operator had to shut down the welding equipment, bleed the hose, insert the cutting torch and adjust the regulators.

However, with the introduction of the cutting attachment to the welding torch, there was a quicker way to go from welding to cutting, without shutting the cylinders.

Now with the welding and cutting outfits there was a quick changeover and an outfit that could cover the full range of maintenance repair, welding and cutting.

Super
AIRCOMASTER
Welding, Cutting & Heating Outfit
AIRCO
Super
AIRCOMASTER
Cuts up to 2½"/welds to 5⁄16"

4. THE AIRCO OUTFITS

The Airco package line consists of four basic outfits.

a. The SUPER AIRCOMASTER (SAM) is the finest outfit on the market. It has no equal in competition.

b. The AIRCOMASTER designed to satisfy the largest range of conditions is used for light to heavy work. It is Airco's most popular outfit.

c. The AIRCOMITE B is a modified version of the AIRCOMITE.

d. The AIRCOMITE is designed to cover nearly the same range of work as the AIRCOMASTER.

Cutting outfits are made up of the standard Airco equipment which has been designed for industrial use where strength and performance are of the essence.

The SUPER AIRCOMASTER Outfit contains:

- Model 800 welding torch
- Three welding tip assemblies—#1, 3 & 5 to weld up to 5/16" (8mm) steel plate.
- One 8400 Style oxygen regulator
- One 8400 Style acetylene regulator
- Model 4800 cutting attachment
- Model 144 cutting tips, sizes #1 and #3 to cut up to 2-1/2" (63mm) steel plate
- Model 842 heating tip, size #10 delivering up to 140 CFH of acetylene
- Goggles, sparklighter, wrench

Hose not supplied with outfit—1/4" (6mm) or 5/16" (8mm) twin hose recommended.

Full capacity of the regulator and torch

Cutting up to 8 inches (203mm)
Welding up to 1 inch (25mm)
Heating—maximum gross heat of combustion in BTU/hour:
Acetylene 300,000 • MAPP® Gas 580,000-700,000
Propane 540,000 • Natural Gas 488,000

You can expand the work range of this outfit by adding larger tips.

The AIRCOMASTER Outfit contains:

- Style 750 welding torch
- Three Style 98 separable welding tip—#1 3 & 5 to weld up to 5/16" (8mm) steel plate
- One gas mixer
- One 9100 Style oxygen regulator
- One 9100 Style acetylene regulator
- Style 4790 cutting attachment
- Style 144 cutting tip #1 to cut up to 1-3/4" (63mm) steel plate
- 20 foot length of 1/4" (6mm) twin hose
- Goggles, sparklighter, wrench

Full capacity of regulator and torch:

Cutting up to 6 inches (152mm)
Welding up to 1 inch plate (25mm)

You can expand the work range of this outfit by adding larger tips.

The AIRCOMITE B Outfit contains:

- Style 750 welding torch
- Three style 70 welding tips—assemblies #1, 3 & 5 to weld up to 5/16" (8mm) steel plate.
- One Style 8000 oxygen regulator
- One Style 8000 acetylene regulator
- Style 3700 cutting attachment
- Style 144 cutting tip—#2 to cut up to 1-3/4" (44mm) steel plate
- Sparklighter

Hose not included with outfit—1/4" (6mm) twin hose recommended

Full capacity of regulators and torch:

Cutting up to 5 inches (12.7mm)
Welding up to 1 inch (25mm)

You can expand the work range of this outfit by adding larger tips.

The AIRCOMITE Outfit contains:

- Style 750 welding torch
- Three Style 98 separable welding tip assemblies—#1, 3 & 5 to weld up to 5/16" (8mm) steel plate
- One gas mixer
- One Style 8000 oxygen regulator
- One Style 8000 acetylene regulator
- Style 3700 cutting attachment
- Style 164 cutting tip—#1 to cut up to 1-3/4" (44mm) steel plate
- Sparklighter

Hose not included with outfit—1/4" (6mm) twin hose recommended

Full capacity of regulators and torch:

Cutting up to 6 inches (152mm)
Welding up to 1 inch (25mm)

You can expand the work range of this outfit by adding larger tips.

5. COMPARISON WITH COMPETITION

OUTFIT REGULATORS FLOW AND PRESSURE CONSIDERATIONS

An ideal single-stage regulator is one that would give the greatest possible gas flow, with no delivery pressure variation throughout the entire discharge range of a cylinder. Unfortunately, this is not yet practical. Certain regulators are designed for high flows, others for best delivery pressure performance. To get good pressure regulation or the least delivery pressure change possible, one must sacrifice gas flow rate and vice versa. High flow rates result in larger delivery pressure variations.

Welding and Cutting Outfits sometimes have serious limitations in work range due to flow restrictions. Regulators, torches, or cutting attachment could be the restriction. The flow capacity of these items should be comparable.

For example, why buy regulators that will deliver more gas flow than the outfit torch flow capacity?

The excess flow capacity of the regulator causes too much pressure change which requires frequent equipment adjustment by the operator.

It is important to remember that it is inevitable that, at one time or another substantial gas flows will be needed when the remaining cylinder pressure will not be high. Will the regulator be able to deliver the needed flow rate under lower cylinder pressure conditions? It must be kept in mind that while good pressure regulation is desirable, it is more important in cutting and heating for a regulator to have good flow rate capability at lower cylinder pressure conditions.

GAS FLOW THROUGH REGULATORS AND TORCHES

There are no standards or universally accepted definitions to compare gas regulator performances. At Airco, we have established operating standards which we apply to all our cylinder regulators. Using this same approach with competitive equipment we obtain tangible comparisons.

The flow rates in Table H-1 show the performance of the regulators used with Airco Outfits. These flows are maximum flows given under two conditions: 1) when the cylinder is nearly full; and 2) when nearly empty. It gives a summary of the flow limits of the regulators. The maximum delivery pressure change during discharge of a cylinder is also noted.

The "Maximum Free Flow" (MFF) performance (explained previously in Section D) of a regulator is meaningless if we only look at the flow obtained when the cylinder is at full pressure. Some of our competitors use this flow condition, which is somewhat deceptive. The maximum flow delivered when the cylinder is "nearly empty" is more meaningful. A nearly empty cylinder can be defined as one which is at a pressure slightly in excess of the rated maximum delivery pressure of the regulator being tested.

The rated flow under this condition shows the maximum continuous flow rate that can be obtained when starting from full cylinder pressure until nearly empty. It is the nearest thing to Maximum Conventional Application (MCA) which means the maximum flow condition that can be demanded of a given regulator for oxy-fuel application.

The following table shows performance comparisons for regulators used in welding and cutting outfits.

REGULATOR PERFORMANCE COMPARISONS

TABLE H-1

Gas Service	Stock Number	Outfits	Max-Delivery P.S.I.	Maximum Flow Delivery			Delivery P.S.I. Change
				Full Cylinder⊕	Nearly Empty		
				CFH	CFH	P.S.I.	
AIRCO							
Oxygen	806 8456	SAM	100	975	550	150	0
Oxygen	806 9106	AIRCOMASTER	120	1425	560	150	6
Oxygen	806 8006	AIRCOMITE	100	1425	375	150	12
Oxygen	806 8026	AIRCOMITE B	100	1425	375	150	12
Acetylene	806 8402	SAM	15	300	250	35	0
Acetylene	806 9102	AIRCOMASTER	15	570	315	35	5
Acetylene	806 8002	AIRCOMITE	15	290	215	35	1
Acetylene	806 8082	AIRCOMITE B	15	290	215	35	1
VICTOR							
Oxygen	SR 400D	JOURNEYMAN	125	3250	550	175	12
Oxygen	SR 200C	SUPER RANGE	80	2450	550	150	10.5
Acetylene	SR 410A	JOURNEYMAN	15	600	235	35	2
Acetylene	SR 210A	SUPER RANGE	15	650	280	35	2.5
SMITH*							
Oxygen	H 1510	Star 98	150	1500	120	200	7
Oxygen	H 1710	Big 98	100	235	60	150	5
Oxygen	H 1910	Cavalier	100	350	160	150	5
Acetylene	H 1520	Star 98	15	560	420	35	.5
Acetylene	H 1720	Big 98	15	285	235	35	1
Acetylene	H 1920	Cavalier	15	400	180	35	1.5
PUROX							
Oxygen	R 205	All Purpose 201	60	1520	400	100	3.5
Oxygen	R 2278	Metal Master 275, 200	60	475	160	100	4
Acetylene	R 207	All Purpose 201	15	200	160	35	1
Acetylene	R 2281	Metal Master 275, 200	15	70	65	35	.5
HARRIS*							
Oxygen	25-100	Expert	100	2260	805	150	4
Oxygen	94-100	Master	100	2800	900	150	9
Acetylene	25-15	Expert & Classic	15	560	280	35	.5
Acetylene	94-15	Master	15	650	300	35	1

⊕ OXYGEN - 2000 lbs.   ACETYLENE - 250 lbs.

* SMITH numbers ending by 300 or 540 denote CGA numbers.

** HARRIS numbers ending by 15 or 100 denote max. delivery p.s.i.

WELDING TORCH CONSTRUCTION

Welding torches are constructed from a number of parts. These parts are assembled in two ways, mechanically or brazed.

Airco torches are silver brazed together (see Figure H-1). The valve bodies, the rear end forging, the two gas tubes and the front end (or head) are silver brazed. Following this, the valve stems are installed and the torch is leak-tested. Then the corn cob handle is slipped over the torch and secured in place. The torch can be subjected to extremely rough treatment and distortion. The silver brazed joints can withstand enormous stress without developing leaks. Mechanically bonded torches are more sensitive to failure with rough treatment than are silver brazed torches.

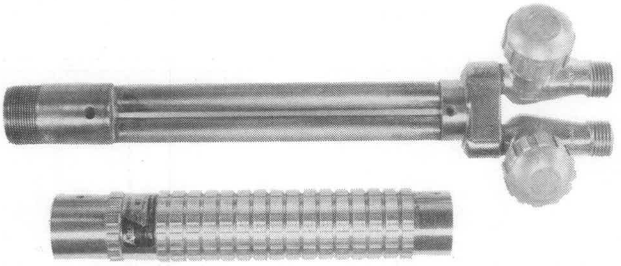


Figure H-1

The competitive method used on one Harris torch and all the Victor torches (see Fig. H-2) consist of mechanical bonding of the parts such as threads, tapered joints and O-ring seals. The handle is a heavy wall tube threaded on both ends to receive the rear-end forging on one end and the head on the other. The handle itself is the fuel tube. The oxygen tube is located inside the handle. It is locked and sealed in place when the rear-end and front-end parts are threaded onto the handle.

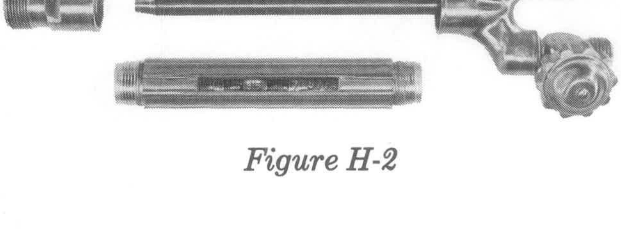


Figure H-2

On the Harris 43-2 torch (see Fig. H-3) the sealing of the handle thread and the inner oxygen tube is done by means of an O-ring. A shock can distort the mounting of the ring, or heat and time damage the O-ring material.

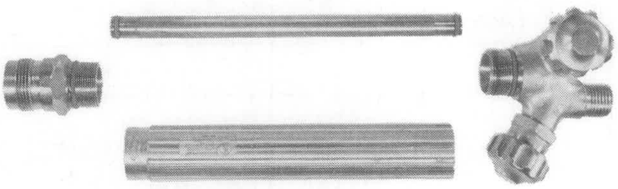


Figure H-3

On the Victor torches the inner oxygen tube is not concentric with the handle. One end of the tube is threaded, off center, into the rear-end forging and the other end is tapered and fitted into a tapered hole in the center of the head. By threading the handle with the rear-end forging and the head, the taper on the oxygen tube is force fitted into the tapered hole in the head. All the threads are sealed with a compound similar to Lock-tite®.

The Victor torch handles, with threaded joints, rely on metal to metal contact and added sealant compound. They are susceptible to leakage through continual usage. The weakest element in this assembly is the tapered oxygen tube as fitted into the head. It seems somewhat unorthodox because it is very questionable that the two tapered surfaces will seal effectively under the stress of continual usage; or in the event that it is taken apart and re-assembled.

The Smith torch (see Fig. H-4) is all silver brazed. However, there are two "blind" silver-brazed joints within the handle which is also silver brazed to the rear-end forging and head. The blind internal joints are difficult to leak test and therefore, a leaky unit may be used, resulting in an accident.

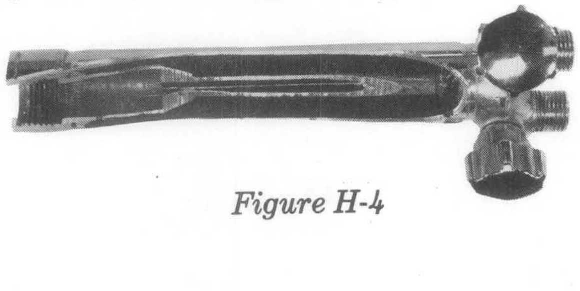


Figure H-4

CUTTING ATTACHMENT CONSTRUCTION

The Airco Cutting Attachments are of the positive pressure, tip-mixing type. They are entirely silver brazed. Style 4700 and 4800 have distortion free stainless steel heads and tubes for strength and minimum maintenance.

Being of the tip-mixing type means that the fuel and oxygen supplied for the preheat flame mix in the tip seat and not in a mixing device in the body of the cutting attachment. Tip mixing gives the maximum safety, performance and flame stability. Any sustained burn back or retrogression of the flame in the cutting tip remains within the tip; Airco tip mix cutting attachments cannot be internally damaged or destroyed as is the case with torch-mix equipment.

With a gas premixing-type torch, a burnback can lodge itself within the gas diffuser or the gas mixing section common to all premixing-type torches. If the torch valves are not very promptly shut off, the subsequent heat melts the wall of the diffuser forging or gas mixing tube, often causing injury to the operator.

This is the reason why the Airco tip-mixing-type torch has been accepted in the European Common Market industries where it has become a generally accepted standard. The other advantage of the tip-mixing system is that, for any given cutting tip size the range of preheat gas flow is substantially larger than with premixed-gas-type torch, and the flame stability remains excellent throughout this wide range flow.

The primary performance criteria of any cutting attachment is cutting oxygen flow capacity. The maximum free flow of cutting oxygen of the Style 4800 is 620 cfh at 50 p.s.i. For the 3700 and 4700 it is 445 cfh at 50 p.s.i.

SUPER AIRCOMASTER OUTFIT (SAM)

The SUPER AIRCOMASTER contains the 8400 series two-stage regulators, that, as previously learned, deliver gas flows at constant pressures. Presently, there is no comparative competitive outfit on the market.

The high capacity welding and heating torch, Style 800, with a corn cob handle for best grip, shrouded valve for valve stem protection and distortion-free stainless steel head for minimum maintenance have been used in the steel fabrication and steel making industries for many years.

The cutting attachment, Style 4800, features distortion free stainless tubes and head for minimum maintenance. Its cutting oxygen flow capacity permits cutting in excess of 8-inch thick steel. The tip mixing design makes it an outstanding unit in that it delivers high preheat flames for the most difficult cutting conditions. The size 10 Universal heating tip delivers high b.t.u. output with any fuel (207,000 b.t.u. with acetylene). The SUPER AIRCOMASTER Outfit has no equal in the marketplace.

AIRCOMASTER vs. Competition vs. Victor Journeyman

AIRCOMASTER Outfits include the 9100 series regulators which have the same MCA (Maximum Conventional Application) flow as the Victor SR 400 regulator. The Airco 9100 regulators have a substantially better delivery pressure regulation (lower delivery p.s.i. change with cylinder pressure drop.)

The Victor 315 torch and CA 1050 cutting attachment have a performance edge on maximum gas flows over the Airco 750 and 4700 cutting attachment. However, the advantages of the Airco torch construction (see Fig. H-1), the Airco tip mixing system of the cutting attachments with its high preheat flame stability over the greatest range of preheat gas flow and its burn-back free feature make the AIRCOMASTER a better buy. In addition, the 4700 attachment can be used with any fuel gas, while the Victor 1050 cannot be used with natural gas.

vs. Harris Master

The Harris Outfit includes the No. 94-100 oxygen regulator which exhibits an unusually high MCA flow, but the delivery pressure regulation does not compare favorably with the Airco 9100 series regulator. This Harris regulator does not have a pressure relief valve. In case of an excessive pressure the bursting of the diaphragm serves as a safety device. The regulator then needs major repair.

The Harris torch handle 43-2F has a higher gas free flow than the Airco 750 torch. However, the torch construction which is superior to the Victor design still does not compare to the Airco dual gas tube all silver brazed assembly. The Harris 73 cutting attachment is the weakest element in this Outfit. It has cutting oxygen flow nearly comparable to the Airco 4800 cutting attachment but it has the very limited preheat gas flow and the very sensitive flame stability inherent to Harris acetylene cutting torch design. Furthermore, it does not lend itself to any possibility of fuel conversion as with the Airco cutting attachments. With Airco cutting equipment, if you want to use another fuel just change to the appropriate Airco tip. As a result we claim that the AIRCOMASTER is superior to the Harris Master Outfit.

vs. Purox Metal Master 201

The Metal Master Outfit includes the R205 and R207 Purox regulators which have somewhat lower gas flows than the Airco 9100 regulators.

The Purox W201 torch is all silver brazed as are Airco torches. The coiled oxygen tube (see Fig. H-5) and the valve design suggests a faint anachronistic twist.

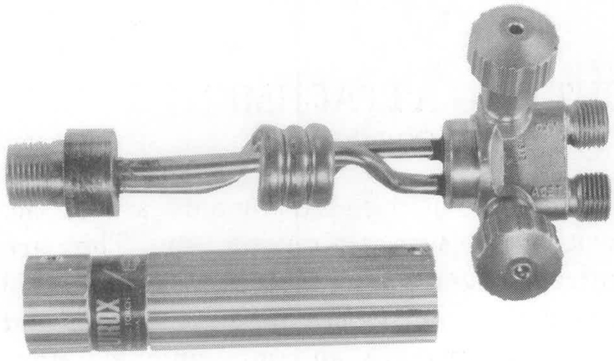


Figure H-5

The Purox CW202 cutting attachment has a good cutting oxygen free flow; however, the gas mixing design makes it susceptible to sustained burn back in the mixing tube with subsequent internal damage to the mixer. As a result we claim that the AIRCOMASTER is superior to the Purox Master 201 Outfit.

vs. Smith Star 98

The Star 98 includes the H1510 and H1520 regulators. The poor oxygen regulator flow delivery is a very limiting factor on the rest of the equipment.

The SW1 welding torch and its silver-brazed assembly has good gas flows. The cutting attachment with its tip mixing design offers much of the same good preheat flow and flame stability of the Airco design. The gas sealing of the tip consists of internal O-rings in the torch head; the cutting oxygen is sealed by a soft seat on the back end of the tip. The claimed "tip hand tightening" feature does not last long due to the packing of the soft seat. The replacement of the damaged O-ring inside the head is troublesome.

The somewhat light construction all brass tubes and the limiting effect of the regulators means that the Star 98 is not comparable to our AIRCOMASTER.

THE AIRCOMITE B AND AIRCOMITE

The AIRCOMITE B and the AIRCOMITE Outfits provide the user with quality equipment at a lower price. The Outfits are designed for welding and cutting in the light-to-medium range (weld up to 5/16"; cut up to 1-3/4"). They are particularly well suited for use in sheet metal work, auto repair and maintenance work on farms, industrial plants, and in the air conditioning and refrigeration fields. Both Outfits contain standard Airco items. The AIRCOMITE has in-line gauge style 8000 Series Regulators and separable welding tips; the AIRCOMITE B has front facing 8000 Series Regulators and welding tip assemblies.

vs. Linde and Smith

The equipment in the AIRCOMITE B Outfit is a good example of Airco "component-matching". This is easily understood when comparing the Outfit with the Smith big 98 and the Purox Metal Master 275. The regulators in the AIRCOMITE B have sufficient capacity for the demands of the torch and cutting attachment throughout their range of work. Our gas flow tables indicate that this is not so for Smith and Purox — and, therefore, is a serious shortcoming of these Outfits. Also, the quality equipment in the Airco Outfit is still a major selling factor. In most selling situations, the "corncob" handle and shrouded valve stems may be just "icing on the cake"; however few can afford to overlook the advantages of Airco's tip-mixing design versus competitive pre-mixing approach. Tip-mixing does prevent damage from sustained burnback. In addition, Airco's stainless steel head and tubes provide maximum strength on equipment that operates under severe conditions.

vs. Harris Expert

The Harris Expert Outfit is an example of what appears to be poor component matching. The Expert oxygen regulator has very high flow performance, when compared with the oxygen regulator in the AIRCOMITE B. But, when comparing other equipment in these Outfits, the Airco 750 torch and 3700 attachment to the Harris 85F torch and No. 72 attachment, the Airco attachment has a much higher cutting oxygen flow rate. The Airco equipment is "well-matched" for the use area; the Harris is not. Again, the Airco tip-mixing system, for high preheat flame stability and safety offers marked advantages over the limited preheat flow, sensative flame stability and susceptability to damage from sustained burnback of the Harris premixed torch.

TORCH AND ATTACHMENT FLOW COMPARISON

Table H-2, provides a convenient reference for evaluating the outfits discussed.

TORCH AND ATTACHMENT FLOW COMPARISON

TABLE H-2

The following table shows gas flows through the most popular torches and attachments used in welding and cutting outfits. Note that the gas flows given are for a specified gas pressure entering the torch and is the same for all the torches.

Maximum Free Flow in Cubic Feet per Hour
Through Typical Torch Handles and Cutting Attachments

LARGE CAPACITY

	AIRCO	HARRIS	VICTOR	SMITH	PUROX
Welding Torch Type	#800	#43-2	#315	#SW1	#W201
Acetylene at 15 P.S.I.	670	695	315	355	320
Oxygen at 30 P.S.I.	930	575	455	470	415
Cutting Attachment Model	# 4800	#73	#CA1050	#SC209	#CW202
Cutting Oxygen at 50 P.S.I.	620	435	560	525	435

MEDIUM CAPACITY

Welding Torch Model	#750	#85F	# 100	#MW5	#W275
Acetylene at 15 P.S.I.	235	190	190	370	345
Oxygen at 30 P.S.I.	460	255	275	505	425
Cutting Attachment Model	#4700	#72	#CA1350	#MC509	#CW275
Cutting Oxygen at 50 P.S.I.	445	325	265	435	255

LESSON PLAN

SUBJECT: TRANSFER LEARNING INTO SELLING—2

OBJECTIVE: To stress how the material learned can be applied to selling.

METHOD: Group Discussion.

REFERENCE: Product Information Class 8 Text
SECTION E: Hose and Connections
SECTION F: Torches
SECTION G: Torch Tips and Applications
SECTION H: Welding and Cutting Outfits

TRAINING MATERIALS: Note Taking Sheet on Transfer Learning Into Selling—2
For SECTIONS E, F, G, and H.

PRESENTATION:

Once again we arrive at the Group Discussion relative to the Transfer Learning Into Selling.

This time we will take into account only the material we have covered today.

What we said in our former discussion still applies. That we are looking for a sharing of sales experiences and an exchange of ideas.

REFER TO NOTE TAKING SHEET ON SECTIONS E, F, G, AND H.

You will be able to record each other's comments on your Note Taking Sheets, SECTIONS E, F, G, and H.

Now that you have become knowledgeable in Torch, Hose, Tips, and Outfits how will it help you sell Class 8 Products?

To get you started here is an example of a Sales Experience:

It is about flame hardening rail heads that are used on a lathe-type machine. The job was originally done with acetylene using a four-cylinder manifold. The critical element was heat transfer. The use of acetylene required close proximity of the flame to the work (the primary cone of an oxy-acetylene flame is the hottest point.) This caused flashback, which caused pitting on the surface of the rail heads, which required welding and grinding to repair.

The recommendation was made to change from acetylene to MAPP® Gas which permitted use of a higher working pressure (above 15 p.s.i.). A cooler tip and a higher secondary flame temperature meant a greater distance from the work piece, and less reflective heat. The customer purchased MAPP Gas equipment, manifolds, regulators, tips, etc.

Now let us have your *sales* experiences:

AFTER A SHARING OF SALES EXPERIENCES ASK FOR AN EXCHANGE OF IDEAS.

Now that we have shared sales experiences, let us exchange *ideas*. Here, for example is a typical idea relating to the discussion we had on competition in SECTION H, Outfits:

Most Airco Regulators have spring loaded safeties, which means that if the pressure is excessive, the relief would pop off but return to its seat.

Some competitive regulators do not have a spring loaded safety feature, some have a bursting disc. In the case of a bursting disc, if the pressure is excessive the bursting disc will blow and the regulator cannot be used. What is the customer going to do to get back into operation?

The Airco Regulator is spring loaded and will return right to its seat once the pressure is reduced.

Now let us have your ideas.

CONCLUSION:
TRAINER SUM UP POINTS COVERED.
EACH PARTICIPANT SHOULD HAVE WRITTEN NOTES UNDER "SALES EXPERIENCES" AND "IDEAS" LISTING THE NAME OF THEIR ACCOUNTS THAT CAME TO THEIR MIND.

TRANSFER LEARNING INTO SELLING—2
NOTE TAKING
GROUP DISCUSSION

SECTION E. — HOSE & CONNECTIONS

SECTION F. — TORCHES

SECTION G. — TORCH TIPS & APPLICATIONS

SECTION H. — WELDING AND CUTTING OUTFITS

NAME YOUR ACCOUNTS
THAT COME TO MIND

SALES EXPERIENCE

NAME YOUR ACCOUNTS
THAT COME TO MIND

IDEAS

LESSON PLAN

SUBJECT:	HOMEWORK ASSIGNMENT
OBJECTIVE:	To have the participant read the more detailed material in the Product Information Class 8 Test
REFERENCE:	Product Information Class 8 Test
TRAINING MATERIALS:	SECTIONS: E, F, G, and H — Hose and Connections; Torches; Torch Tips and Applications; Welding and Cutting Outfits. Glossary of Terms

PRESENTATION:

The homework assignment is to read the detailed material in the Product Information Class 8 Text SECTION E, F, G, H, and Glossary of Terms.

Tomorrow's class will begin with a test on the material presented in class today. The test will not cover the detailed homework assignment, the video tapes or any demonstrations.

GLOSSARY OF TERMS

AMBIENT TEMPERATURE — The temperature of the surrounding air.

BACKFIRES AND FLASHBACKS

Backfire and its Causes — A backfire is a loud noise produced by the explosion of gases at the cutting or welding tip usually following a minor flashback, extinguishment, and re-ignition at the tip. Repeated backfire can cause tip to overheat and eventually cause a sustained flashback. Causes are:
a. Bringing tip too close to work or touching it.
b. Foreign particles entering tip and impeding gas flow.
c. Overheated tip, such as caused by working in corners.
d. Trying to operate with too low a gas flow.

Flashback and its Causes — A flashback is a retrogression of the flame from tip back into or through the torch. It is also called a sustained burning in tip or torch.

A flashback can be caused by equipment that is faulty or misused. If it does not cause fire or rupture of hose, then it may produce hissing or squealing due to burning inside torch or tip (usually at the mixer). Examples of faulty or misused equipment are:
a. Failure to purge
b. Incorrect pressures
c. Distorted or loose tips or adapter seats
d. Kinked hoses
e. Clogged tip or torch orifices
f. Overheated tip to torch

BRITISH THERMAL UNIT (B.T.U.) — A b.t.u. is the amount of heat required to raise the temperature of one (1) pound of water, one (1) degree fahrenheit.

CARBURIZING FLAME — An oxy-fuel gas flame in which there is more fuel than oxygen, relative to the required ratio of oxygen-to-fuel for complete combustion.

COUPLING DISTANCE — The distance from the end of a cutting tip to the work.

With acetylene the coupling distance is necessarily shorter because of the high b.t.u. output of the primary flame and the relatively lower b.t.u. output of the secondary flame.

The coupling distance of propane and MAPP Gas is longer because of their high B.t.u. output in the secondary flame. MAPP Gas having a decided edge because it also has a high b.t.u. output in the primary flame. The coupling distance of the propane and MAPP Gas flames is not critical. The point of highest temperature is generally considered to be downstream of the primary flame, at a distance which is equal to three-quarters the length of the primary flame.

Natural gas has the lowest overall b.t.u. output. It is compensated by applying larger volume of gas for a given work. There is no particular recommendation as to what is the best coupling distance for best heat transfer. Usually the proximity of the end of the primary flame to the work.

DENSITY OF A GAS — The weight per unit volume of the gas at a given temperature and pressure.

DRAG — The drag of a cut is the distance the kerf lines at the bottom surface of the metal being cut lag behind the kerf lines at the top.

KERF — Width of cut made by torch. Governed by tip size, tip design, position of preheat flames and gas pressures.

MCA — MAXIMUM CONVENTION APPLICATION — A flow rate used by Airco to represent the flow rate of gas a regulator will deliver at reasonably low cylinder pressure.

MFF — MAXIMUM FREE FLOW — A flow rate used by most regulator manufacturers to represent the flow rate of gas a regulator will deliver at full cylinder pressure.

NEUTRAL FLAME — An oxy-fuel gas flame in which there is the proper amount (ratio) of fuel and oxygen for neutral combustion. MAPP Gas is 2.5 to 1 ratio: acetylene is 1.1 to 1.

OXIDIZING FLAME — An oxy-fuel gas flame in which there is more oxygen than needed for complete combustion.

PRESSURE AND FLOW — There must be a sufficient volume flow per unit of time through any cutting or welding apparatus in order to do any flame cutting, welding, heating, etc. This will assure the amount of heat required for the job.

In some apparatus, flowmeters are used to measure the flow rate. In many cases flowmeters are not used, and flow rates are controlled by measuring pressure at various points in the system. For example, regulator delivery pressure, torch entry pressure, etc.

STOICHOMETRIC — A chemical term used to express the "ideal" quantity of substances (or elements or compounds) required to obtain complete combustion.

For Example:

$C_2H_2 + 2\frac{1}{2}\,O_2$	$2CO_2 + H_2O$
Acetylene + Oxygen	Carbon Dioxide + Water

One volume (quantity) acetylene plus $2\frac{1}{2}$ volumes of oxygen yields 2 volumes of carbon dioxide and one volume of water (vapor).

TEMPERATURE — Sometimes expressed in fahrenheit, °F., or in centigrade °C. For example, see the table below:

	°F		°C
	6000		3315
	5000		2760
	4000		2250
	3000		1649
	2000		1093
	1000		538
	500		260
(Water boils)	212		100
(Normal ambient)	70		21
(Water freezes)	32		0
	0	Fahrenheit	—18
	—20	equals	—29
	—40	← Centigrade →	—40
	—65	at this level	—54

WITHDRAWAL RATE — The flow rate of gas that can be withdrawn from a cylinder.

In the case of acetylene, the withdrawal rate is limited to 1/7th of the contents per hour. For example, in a 350 c.f. cylinder the limit is about 50 c.f.h. (the purpose is to avoid withdrawal of acetone).

In the case of MAPP Gas and propane, the withdrawal rate is limited by the vaporization rate of liquid in the tank and will vary with the type of gas, the ambient temperature, and the amount of liquid in the tank. Tables for MAPP Gas withdrawal rates are available in Section B.

AGENDA

THIRD DAY/A.M.
8:30 — 9:00

TEST, Score your own test
9:00 — 9:30

STUDY TIME for review of material not understood
9:30 — 10:00

SECTION I: ACCESSORIES
10:10 — 10:15

COFFEE BREAK — Demonstration Hand Flame Cutting
10:15 — 10:30

SECTION J: PROPORTIONERS
10:30 — 11:00

SECTION K: SMALL MACHINES
11:00 — 11:30

POSITIVE ACTION PLAN
11:30 — 12:00

FINAL TEST

LESSON PLAN

SUBJECT: ADMINISTERING TESTS

OBJECTIVE: To determine if the participant understood the material. Everyone should achieve 100%.

METHOD: Written Tests

REFERENCE: Product Information Class 8 Text

TRAINING MATERIALS: Tests and answers on SECTION E, F, G, and H.
Third Day materials includes SECTION I, J, K and Positive Action Plan.

PRESENTATION:

We will now have a written test on Sections E, F, G, and H, Hose and Connections, Torches, Torch Tips and Applications, and Welding and Cutting Outfits.

Again, we are striving for a complete understanding of the material. We hope that each of you will achieve 100%.

After you have taken the test, you are to check your answers with the answers given on the next page.

Keep your own score. Just count the number right and the number wrong in each Section.

TRAINER:
NOW TURN TO LESSON PLAN ON STUDY TIME WHICH FOLLOWS THE TEST ANSWERS.

TEST
SECTION E: HOSES AND CONNECTIONS

1. The most trouble that inexperienced operators encounter in oxy-fuel work is caused by insufficient amount of gas flow. The causes of low gas flow are listed below. Circle the one that does not apply.
   a. Demand exceeds the rate of fuel released from a cylinder.
   b. Restrictions in the fittings.
   c. Hose — condition, length, size—to small causes gas friction.
   d. Test gauges mounted between torch and check valves.

2. In order to maintain adequate torch entry pressure the regulator pressure should be set (higher/lower) than the torch entry pressure.

3. Airco twin hose is better than competition because of its exceptionally close and tight ________________; uniform inner hose _______________.

4. The carcass of the Airco single line hose has a burst strength of _____________ times the maximum working pressure.

5. A hose connection consists basically of a __________ and _____________.

6. A hose _____________________ is used to connect lengths of hose.

7. The end of a new hose has a ___________________.

TEST

SECTION F: TORCHES

1. WELDING AND HEATING TORCHES COMPARISONS WITH COMPETITION

Given the Airco features, place the appropriate benefit in the column marked BENEFIT. Given the Competitive feature, place the appropriate shortcoming in the column marked, SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	**FEATURE**	**SHORTCOMING**	**FEATURE**
			VICTOR
	Silver brazed internal parts		mechanically bonded joints with compound sealer.
	mechanically fastened outer handle		single tube, the handle is the fuel tube
	two gas tubes in all popular torches.		oxygen tube is force fitted into the tapered head.
			HARRIS
			threaded assembly
			sealed with rubber O-rings
			oxygen tube is internally mounted and the fuel tube is the handle
			SMITH
			all brazed joints

Check chart on page TD-13.

TEST
SECTION F: TORCHES
2. CUTTING TORCH
COMPARISONS WITH COMPETITION

In the scrambled listing below circle the items that apply to Airco Hand Cutting Torches and place them under the column marked, AIRCO HAND CUTTING TORCHES. Place those items that apply to competitors under the column marked COMPETITION HAND CUTTING TORCHES.

Primarily brass or bronze head
Simplicity of design
Premix
Tip mix
Can be used with all fuel gases
No flashbacks
Stainless steel on special order

Optional external injector adapter
Stainless steel or brass head
Complex design
Internal assembly must be changed for certain gases and applications
Susceptible to flashbacks
Limited application

AIRCO HAND CUTTING TORCHES	COMPETITION HAND CUTTING TORCHES
	Check chart on page TD-14.

TEST
SECTION G: TORCH TIPS AND APPLICATIONS

1. An air fuel tip consists of a ________ and a ________ tube.

2. The RAM JET tip is a conventional tip. (True/False)

3. When doing delicate work, the ____________-__________ flame tip is used.

4. When a low pressure injector is installed on a welding torch handle, it becomes a ______ ________________ torch.

5. The need for injectors was necessary because sufficient pressure was not available to operate ________________ pressure mixers.

6. A ________________ pressure mixer uses a medium pressure of fuel arbitrarily defined as pressure above ________ p.s.i.

7. There are available three types of welding tips. Fill in the blank spaces.
   a. __________________ tip with 3/8" O.D. Copper tube, sizes 00 to 10.
   b. __________________ tips of 7/16 O.D. tube sizes 1 to 10.
   c. A ______ __________ assembly made of 3/8" O.D. sizes oo to 10.

8. The largest sizes of Universal heating tips are numbers ____, ____, ____ and are not to be used with ________________ fuel gas.

9. In oxy-fuel cutting the preheat flames serve several functions. Circle the one that does not apply.
   a. Protect oxygen from surrounding air.
   b. Remove mill scale
   c. Bring steel to kindling temperature
   d. Controls the rate of speed of the cut

10. High speed cutting tips come in either ______ piece or ______ pieces with a __________________ bore.

11. Cutting tips are designated in much the same way as welding tips — by a numerical range in which the (smaller/larger) the number, the (smaller/larger) the openings.

12. Master tips are made in four styles—two styles for ______________ ______________ cutting and two styles for ______________ cutting.

TEST

SECTION H: WELDING AND CUTTING OUTFITS

AIRCO OUTFITS COMPARISONS WITH COMPETITION

Given the AIRCO feature, place the appropriate benefit in the column marked BENEFIT. Given the competitive feature, place the appropriate short coming in the column marked SHORTCOMING.

AIRCO		COMPETITION	
BENEFIT	FEATURE	SHORTCOMING	FEATURE
AIRCOMASTER Regulator-Style 9100		VICTOR—JOURNEYMAN Regulator-Style SR400	
	Neoprene diaphragm		Stainless steel diaphragm
Torch Handle-Style 750		Torch Handle-Style 315	
	Dual gas tubes silver brazed		Inner gas tube, mechanical joint, outer gas tube is the grip.
Cutting Attachment-Style 4700		Cutting Attachment-Style CA1050	
	Tip Mixing		Premixing

COMPETITION		COMPETITION	
SHORTCOMING	FEATURE	SHORTCOMING	FEATURE
HARRIS—MASTER Regulator-Style 94		SMITH—STAR 98 Regulator-Style H1520	
	Diaphragm used as relief valve		Buna-N diaphragm plus diaphragm bearing plate
Torch Handle-Style 43-2F		Torch Handle-Style SW1	
	Inner gas tube, and outer gas tube handle sealed by O-rings		Inner and outer tube brazed; outer tube blind joints
Cutting Attachment-Style 73		Cutting Attachment-Style SC209	
	Injector mixing		Exposed O-rings on slip-in design

TEST

SECTION H: WELDING AND CUTTING OUTFITS

AIRCO OUTFITS COMPARISONS WITH COMPETITION

AIRCO		COMPETITION	
BENEFIT	FEATURE	SHORTCOMING	FEATURE
AIRCOMITE AND AIRCOMITE B		VICTOR—SUPER RANGE	
Torch Handle-Style 750		Torch Handle-Style 100	
	Dual gas tubes silver brazed		Inner gas tube, mechanical joint, outer gas tube is the grip.
Cutting Attachment-Style 3700		Cutting Attachment-Style CA1350	
	Tip mixing		Premixing

COMPETITION		COMPETITION	
SHORTCOMING	FEATURE	SHORTCOMING	FEATURE
HARRIS—EXPERT Torch Handle-Style 85F		SMITH—BIG 98 Torch Handle-Style MW5	
	Staked (rivet like) fasteners on outer handle		Inner gas tube, mechanical joint, outer gas tube is the grip
Cutting Attachment-Style 72		Cutting Attachment - Style MC509	
	Injector mixing		Exposed O-rings on slip-in design

Check your answers on pages TD-16 and TD-17.

ANSWERS
FOR TESTS
SECTIONS E, F, G AND H

ANSWERS
SECTION E: HOSE AND CONNECTIONS

1. d. Test gauges mounted between torch and check valves

2. Higher

3. Braid, diameter

4. Four

5. Nut, gland

6. Coupling

7. Ferrule

ANSWERS
SECTION F: TORCHES
WELDING AND HEATING TORCHES
COMPARISONS WITH COMPETITION

AIRCO		COMPETITION	
FEATURE	**BENEFIT**	**FEATURE**	**SHORTCOMING**
		VICTOR	
Silver brazed internally	Can withstand stress, no leaks; no downtime	mechanically bonded and use of compound sealer	more sensitive to rough treatment, leaks cause downtime
Mechanically fastened outer handle	easy to repair and inspect		
Two gas tubes in all popular torches	Torch handle does not become a hazard in the hand of an operator	Single tube, the handle is the fuel tube	Torch handle a hazard
		Oxygen tube is force-fitted into a tapered head.	Questionable whether the two surfaces will seal effectively under stress of constant use—more susceptible to leakage. If tube is installed incorrectly, head cannot be put on torch assembly.
		HARRIS	
		Threaded assembly	more susceptible to leakage through rough handling
		Sealed with Rubber O-rings	Deteriorate with heat and time. Metal parts may distort and result in leaks.
		Oxygen tube is internally mounted and the fuel tube is the handle.	Torch handle is a hazard.
		SMITH	
		All silver brazed joints	Although silver brazed joints are more durable than mechanical joints, there are two blind joints which are difficult to leak test therefore a leaky unit can be sold and an accident occur.

ANSWERS
SECTION F: TORCHES

AIRCO	COMPETITION
Simplicity of design	Primarily brass or bronze head
Tip mix	Premix
Can be used with all fuel gases	Stainless steel on special order
No flashbacks	Complex design
Optional external injector adapter	Internal assembly must be changed for certain gases and applications
Stainless steel or brass head	Susceptible to flashbacks
	Limited application

ANSWERS
SECTION G: TORCH TIPS AND APPLICATIONS

1. Base, Bent
2. False
3. Pencil-point
4. Lose Pressure
5. Positive
6. Positive, one
7. Separable, separable, tip mixer
8. 16, 17, 18, acetylene
9. d. Controls the rate of speed of the cut
10. One, two, divergent
11. Smaller, smaller
12. General purpose, machine

ANSWERS
SECTION H: WELDING AND CUTTING OUTFITS
AIRCO OUTFITS VERSUS COMPETITION

AIRCOMASTER

AIRCO	
FEATURES	BENEFITS
REGULATOR—STYLE 9100	
Neoprene diaphragm is more sensitive to pressure changes.	More constant delivery pressure
TORCH HANDLE—STYLE 750	
Corn cob grip	Non-slip
Dual gas tubes silver brazed	Maximum safety from leakage and explosion
CUTTING ATTACHMENT—STYLE 4700	
Tip mixing	Flame stability—no flashback, use any gas.
Stainless head and tubes	Minimum maintenance and durable

COMPETITION	
FEATURES	SHORTCOMINGS
VICTOR JOURNEY MAN REGULATOR—STYLE SR400	
Stainless steel diaphragm less sensitive to pressure changes	Greater pressure change in use, requires adjustment more often
TORCH HANDLE—STYLE 315	
Smooth, lightly ribbed grip	More slip
Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE CA1050	
Premixing	Change attachment or mixer depending on gas or thickness of material.
Bronze head and stainless tubes	More frequent maintenance; less durable.

COMPETITION	
FEATURES	SHORTCOMING
REGULATOR STYLE 94 HARRIS — MASTER	
Diaphragm used as relief valve	Diaphragm bursts if regulator is overpressurized, and needs to be replaced. Does not have a safety relief valve.
TORCH HANDLE—STYLE 43-2F	
Smooth, lightly ribbed grip	More slip
Inner gas tube, and outer gas tube (handle) sealed by O-rings	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE 73	
Injector mixing	Change attachment or mixer depending on gas or thickness of material. Limited preheat gas flow. Sensitive flame stability.
Brass head	More frequent maintenance, less durable

COMPETITION	
FEATURES	SHORTCOMINGS
SMITH — STAR 98 REGULATOR — STYLE H1520	
Buna-N diaphragm plus diaphragm bearing plate	Reduced sensitivity of diaphragm due to bearing plate; results in greater pressure change in use. Requires adjustment more often.
TORCH HANDLE—STYLE SW1	
Smooth, ribbed grip	More slip
Inner and outer tubes brazed; inner tube blind joints; outer tube is the grip (handle)	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE SC209	
Tip mixing Slip-in design has O-rings exposed	Flame stability is good, but exposed O-rings on slip-in design, easily damaged.
Brass head	More frequent maintenance, less durable

ANSWERS
SECTION H: WELDING AND CUTTING OUTFITS
AIRCO OUTFITS VERSUS COMPETITION

AIRCOMITE AND AIRCOMITE B

AIRCO FEATURES	AIRCO BENEFIT
TORCH HANDLE—STYLE 750	
Corn cob grip	Non-slip
Dual gas tubes silver brazed	Maximum safety from leakage and explosion.
CUTTING ATTACHMENT—STYLE 3700	
Tip mixing	Flame stability—no flashback; use any gas.

COMPETITION FEATURES	COMPETITION SHORTCOMING
VICTOR-SUPER RANGE: TORCH HANDLE—STYLE 100	
Smooth, lightly ribbed grip	More slip
Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and
CUTTING ATTACHMENT—STYLE CA1350	
Premixing	Change attachment or mixer depending on gas or thickness of material.

COMPETITION FEATURES	COMPETITION SHORTCOMINGS
HARRIS EXPERT: TORCH HANDLE — STYLE 85F	
Staked (rivet-like) fasteners on outer handle.	Makes it very impractical to repair. Has limited flow.
CUTTING ATTACHMENT—STYLE 72	
Injector mixing	Change attachment or mixer depending on gas or thickness of material.

COMPETITION FEATURES	COMPETITION SHORTCOMING
SMITH — BIG 98: TORCH HANDLE — STYLE MW5	
Smooth, lightly ribbed grip	More slip
Inner gas tube, mechanical joint, outer gas tube is the grip	More prone to leakage and explosion
CUTTING ATTACHMENT—STYLE MC509	
Tip Mixing Slip-in design has O-rings exposed	Flame stability is good, but exposed O-rings on stip-in design, easily damaged.

LESSON PLAN

SUBJECT: STUDY TIME—THIRD DAY

OBJECTIVE: To review material that has not been understood by forming to meet the individual needs.

METHOD: Special Group Formation.

REFERENCE: Product Information Class 8 Section E, F, G, and H.

TRAINING MATERIALS: Tests and answers to SECTION E, F, G, and H.

PRESENTATION:	We will briefly review the answers to the test and help clarify material that has not been understood.
AFTER CLARIFICATION OF INFORMATION	To give each of you time to review material not understood, we will call this portion of the program STUDY TIME. The Study Time will last 30 minutes. There will be four groups formed. A group leader will be chosen for each group.
THE GROUP FORMATION WILL VARY ACCORDING TO THE NUMBER OF PARTICIPANTS AND THEIR UNDERSTANDING OF THE MATERIAL. FOR EXAMPLE: 1. THREE GROUPS—MATERIAL ONE GROUP—PRESENTATIONS 2. ONE GROUP—MATERIAL TWO GROUPS—PRESENTATIONS 3. OR ANY OTHER COMBINATION WHICH MAY BE MORE FEASIBLE	Group 1—Review Sections E and F Hose and Connections; Torches. Group 2— Review Section G Torch Tips and Applications. Group 3— Review Section H Welding and Cutting Outfits Group 4— Presentations— a. This group is for participants who fully understand all the material. Each participant in this group 4 will be given a topic to present which will be related to the material covered on the previous day. If you achieved 100% in each section on the test, join Group 4 Presentations during this study time.
TRAINER: SELECT A LEADER FOR GROUP 1, 2, 3 AND 4 ASSIGN SUBJECT TO PARTICIPANTS IN GROUP 4 PRESENTATIONS	By checking your score, you can determine which group to join for reinforcement of the material in which you need more time to study.
TRAINER: ROTATE FROM GROUP TO GROUP	If you did not achieve 100% in one Section or two Sections, join the group during study time which will help meet your individual need. You can move from one group to another. After you clarify all the information, if there is sufficient time remaining move into Group 4 — Presentations.
CONCLUSION: IF THERE ARE ANY POINTS YOU PICKED UP DURING THIS STUDY TIME, DISCUSS IT.	We will select a leader for each Group. Those of you who will join Group 4, you will have 10 minutes to prepare and 3 minutes to present an assigned subject.

LESSON PLAN

SUBJECT: SECTION I: ACCESSORIES

OBJECTIVE: To familiarize the participant with accessory equipment and its use.

REFERENCE: Product Information
Class 8 Text
Section I: Accessories

TRAINING MATERIALS: Product Information
Class 8 Text
Section I: Accessories

PRESENTATION:

REFER TO TEXT MATERIAL IN SECTION I: ACCESSORIES FOR ALL ITEMS LISTED:

1. CHECK VALVES PAGE I-6
2. TIP CLEANERS PAGE I-8
3. GAS-MIZER PAGE I-9
4. GUIDE ROLLER ATTACHMENT PAGE I-9
5. FLASH CIRCLE BURNER PAGE I-10
6. DUPLEX TIP HOLDER PAGE I-11
7. PREHEAT BEVEL ADAPTER PAGE I-13

I. Check Valves
  A. Prevent the reverse flow of mixed gases in torch hoses or regulators. This, in turn, prevents fires or explosions.
  B. Safety devices that should be used with any oxy-fuel system.
  C. Types
    1. Torch check valves attached directly to torch handle valves.
      a. Sizes "A" to "B" — "B" size comes in pairs in Check ✓ Pac.
    2. Regulator check valves fit "B" size hose connections and directly on "B" size regulator outlets.

II. Tip Cleaners
  A. Airco tip cleaners clean the slag and splatter from the welding and cutting tips. Scale in the bore distorts the shape of the flame and may lead to backfires.
  B. Types
    1. Tip cleaner sets—pieces of stainless wire of sizes matching the drill sizes. Four sets of various sizes.
    2. Fiber cleaner for divergent tips.
    3. Brass bristle brush—for cleaning insert splines of all two-piece tips.
    4. Tapered reamers—for reconditioning the divergent mouth of oxygen cutting orifice.

III. Gas Mizer
  A. Saves gas and constant resetting of torch. STOPS the flow of oxygen and fuel when the torch is hung on the hook. When the torch is picked up gas starts to flow. Pilot light permits easy relighting.
  B. For operations requiring intermittent use.
  C. Installed between the regulator and torch.

IV. Guide Roller Attachment
   A. Maintains constant tip to work distance during hand cutting operations.

V. Flash Circle Burner
   A. Together with a hand cutting torch cuts circles 2½" to 17" in diameter.
   B. A 22" extension bar increases the range to 60".

VI. Duplex Tip Holder
   A. Permits 2 parallel cuts to be made simultaneously with one Airco cutting torch.

VII. Preheat Beveling Adapter
   A. Recommended because of heat loss when bevel cutting.
   B. The offset preheat nozzle applies a portion of the preheat in advance of the cutting tip.

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION I
ACCESSORIES

1. Check Valves
2. Tip Cleaners
3. Gas Mizer
4. Guide Roller Attachment
5. Flash Circle Burner
6. Duplex Tip Holder
7. Preheat Bevel Adapter

1. CHECK VALVES

CAUSES OF REVERSE FLOW

Torches, hoses and regulators do not prevent reverse flow which can occur during operation. Only properly installed check valves offer reverse flow protection.

Check valves are safety devices that should be used with any oxy-fuel system. They prevent the reverse flow of mixed gases in torch hoses or regulators which can be the cause of serious accidents, injury and damaged equipment.

Some conditions under which reverse flow occurs during operation without check valves are:

1. A plugged welding tip will cause reverse flow of gas into the gas supply hose in which the gas is at the lowest pressure.
2. An oxygen cylinder may become empty during use, resulting in the loss of pressure. Reverse flow of higher pressure fuel gas into the oxygen hose and regulator will occur before the operator turns off the torch oxygen valve.
3. Poor lighting procedure or improper hose purging procedure due to ignorance or laziness can result in reverse flow situation.

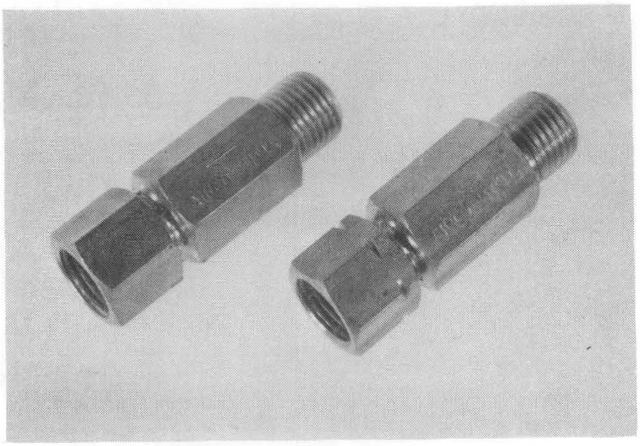
Check valves do not replace recommended safe practices for gas handling. The use of check valves and adherence to recommended safe practices will minimize operator exposure to many hazardous conditions that can otherwise occur from reverse flow of mixed gases.

AIRCO CHECK VALVE FEATURES

- High gas flow capacity
- Prevent reverse flow
- U.L. Listed
- 100% inspected
- Designed for easy seating
- Spring-loaded, floating piston check mechanism ensures effective reverse flow protection.

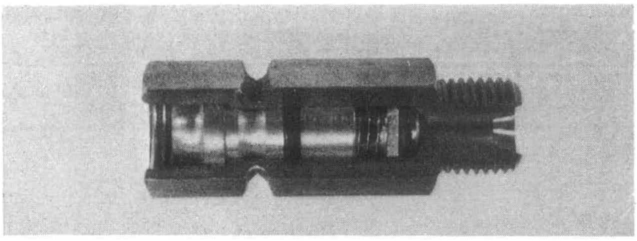
TORCH CHECK VALVES

Airco torch check valves attach directly to torch inlet valves. They are available in sizes "A" to "B" for torches. "B" size torch check valves are also available in convenient Check ✓ Pac.



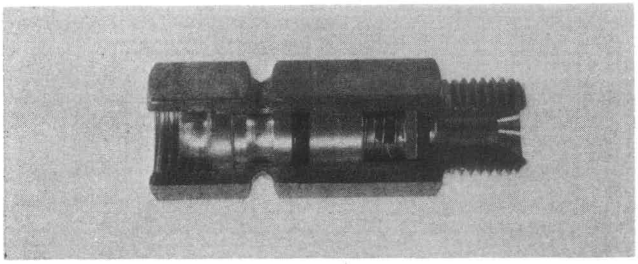
REVERSE-FLOW CHECK VALVES

TORCH CHECK VALVES		CONNECTIONS	
SERVICE	STOCK NO.	TORCH END	HOSE END
Oxygen "A"	831-2770	3/8"-24 R.H. Int.	3/8"-24 R.H. Ext.
Fuel Gas "A"	831-2771	3/8"-24 L.H. Int.	3/8"-24 L.H. Ext.
Oxygen "B"	831-2636	9/16"-18 R.H. Int.	9/16"-18 R.H. Ext.
Fuel Gas "B"	831-2635	9/16"-18 L.H. Int.	9/16"-18 L.H. Ext.



NORMAL

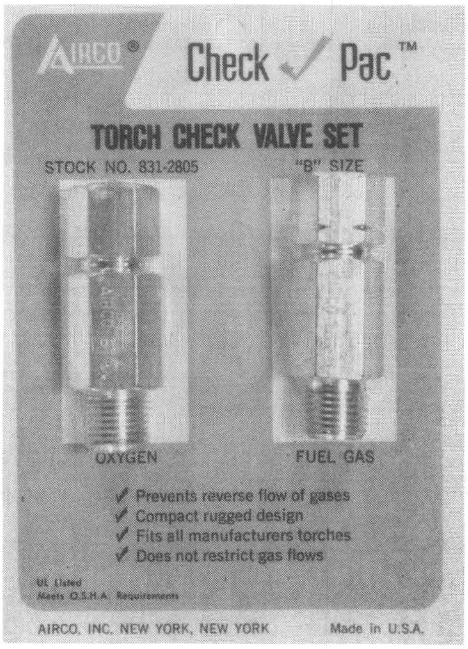
Under normal flow conditions, checking mechanism opens to permit full flow to pass through the check valve.



REVERSE FLOW

Under reverse flow conditions, checking mechanism closes immediately to prevent reverse flow.

Cut away of Airco torch check valve illustrates floating piston checking mechanism to insure effective seating.


AIRCO®
Check ✓ Pac™
TORCH CHECK VALVE SET
STOCK NO. 831-2805
"B" SIZE
OXYGEN
FUEL GAS
✓ Prevents reverse flow of gases
✓ Compact rugged design
✓ Fits all manufacturers torches
✓ Does not restrict gas flows
UL Listed
Meets O.S.H.A. Requirements
AIRCO, INC. NEW YORK, NEW YORK
Made in U.S.A.

TORCH CHECK – ✓ – PAC

"B" SIZE	831-2805	Oxy. 9/16"-18 R.H. Int. Fuel 9/16"-18 L.H. Int.	Oxy. 9/16"-18 R.H. Ext. Fuel 9/16"-18 L.H. Ext.

REGULATOR CHECK VALVES

Regulator check valves are available to fit "B" Size Hose connections to fit directly on "B" size regulator outlets or with 1/4" N.P.T. fitting to replace a regulator outlet gland.

REGULATOR CHECK VALVES		CONNECTIONS	
SERVICE	**STOCK NO.**	**REGULATOR END**	**HOSE END**
Oxygen "B" Fuel Gas "B"	803-0307 803-0306	9/16"-18 R.H. Int. 9/16"-18 L.H. Int.	9/16"-18 R.H. Ext. 9/16"-18 L.H. Ext.
Oxygen "B" Fuel Gas "B"	830-2854 830-2853	1/4" NPT Male 1/4"NPT Male	9/16"-18 R.H. Ext. 9/16"-18 L.H. Ext.

2. TIP CLEANERS

TIP CLEANER SETS

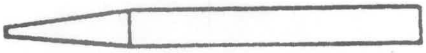
Get clean, hot flames by keeping your welding and cutting tips free from slag and splatter with an Airco Tip Cleaner Set. These carbon steel cleaners are easily applied and when used properly, will not injure cutting or welding tip ports by scratching or deforming. Packed in sturdy metal containers, Airco tip cleaners are convenient for the operator to store, handle and use. Standard Model for drill sizes 75 to 49; Jumbo Model for drill sizes 48 to 30; in Extra Long Model for drill sizes 75 to 49; Master Model for drill sizes 75 to 30. Individual replacement tip cleaners are also available.

CONVENIENT TIP CLEANING SETS

Model	Stock Number
1. Standard	832-4597
2. Extra Long (4-1/2")	833-7499
3. Jumbo	832-4598
4. Master	833-1163

TIP CLEANING AND REPAIR TOOLS

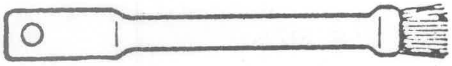
1. Fiber cleaner for divergent tips. This is the only cleaner recommended for the finely-machined, divergent orifice of the cutting oxygen orifice of high speed cutting tips style 45; 45M; 351; 361; 363; 364.



832-3420

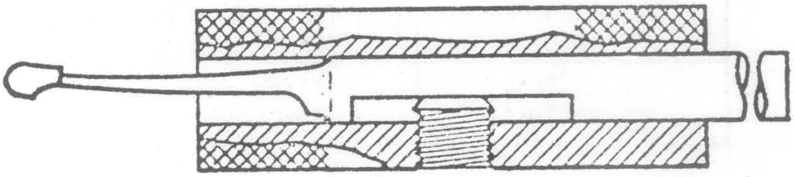
2. Brass Bristle Brush for insert splines. This brass bristle brush is recommended for the cleaning of the insert splines of all two-piece tips.

833-4906



3. Tapered Reamers for reconditioning the divergent mouth of oxygen cutting orifice of divergent tips style 45; 45M; 351 — 361. These tools are essentially for repair and not for routine cleaning. They do not apply to Style 351-361 Size "O" where 833-7776 is used.

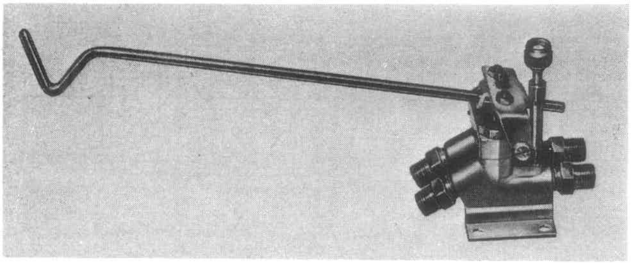
Airco Tip No.	Reamer Stock Numbers
0	832-3450
1	832-3451
2	832-3452
3	832-3453
4	832-3454
6	832-3456
8	832-3458
10	832-3460



3. GAS MIZER

GENERAL TORCH

A GAS-MIZER can save up to 30% on oxygen and fuel gas consumption in operations where torches are used intermittently. Installed between the regulator and torch, a GAS-MIZER will close off the flow of oxygen and fuel gas whenever the torch is hung onto the handy arm hook. When the torch is picked up, the GAS-MIZER starts the flow of oxygen and fuel gas.



Gas Mizer

Drilled for bench mounting the GAS-MIZER may be mounted right at the working area for maximum convenience. The inlet and outlet have connections for 1/4" or 5/16" size hose.

HOW TO ORDER A GAS MIZER

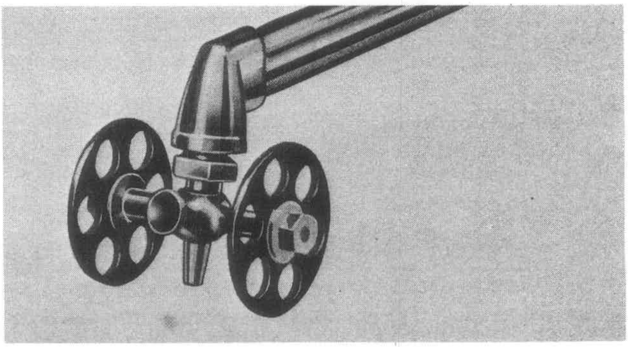
Service	Stock Number
Acetylene	803-0175 *
Propane, Natural Gas	803-0475
Heliweld (TIG) Welding	803-0225

*The 803-0175 GAS-MIZER can be converted for propane or natural gas by using 803-0385 pilot light assembly.

4. GUIDE ROLLER ATTACHMENT

Guide Roller Attachment — This industrial torch accessory improves the consistency and quality of hand cutting torch operations. The Guide Roller attachment maintains 90° tip-to-work surface angle. A thumb screw is used to set required height. Two easy-rolling, warp-resistant wheels simplify operation and reduce operator fatigue.

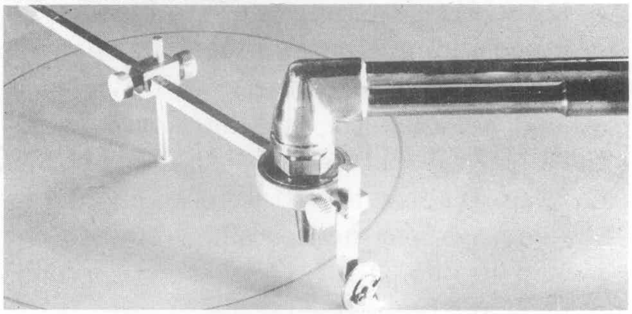
This attachment is well suited for 1100; 3000; 9000; and 9500 series torches and 3700; 4700 and 4800 series cutting attachments with 75° or 90° heads.



Guide Roller Torch Attachment

5. FLASH CIRCLE BURNER

Flash Circle Burner — Cut accurate circles 2-1/2" to 17" in diameter with a hand cutting torch and the versatile flash circle burner. A 22" extension bar assembly (831-1448) increases the range of the circle burner to 60" diameter circles. A rotary ball bearing torch head mount insures smooth running operation. The radius bar is square for perfect tip alignment. A heat-treated tracking wheel prevents sticking. For styles 1100, 2900, 3000, 9000 and 9500 torches and 3700, 4700, and 4800 attachments order 831-1369. For 1490 and 2400 attachments order 831-2301.

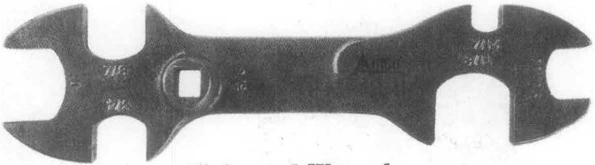


Flash Circle Burner Attachment

ADDITIONAL GENERAL TORCH ACCESSORIES

The UNIVERSAL WRENCH has six openings which fit Airco torch head nuts, hose nuts, check valves and cylinder connection nuts on most Airco regulators. In addition, this wrench has one opening in the handle which is an acetylene cylinder key for Airco or POL cylinder valves. Close tolerance openings prevent unnecessary damage to brass nuts.

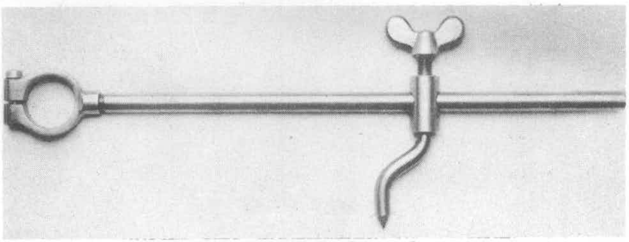
Dimensions of openings are 7/16", 11/16" 3/4", 7/8", 1", and 1-1/8". Stock number 809-0028.



Universal Wrench

Circular Cutting Attachment — Precise circle cutting with straight head hand torches or machine torches is easily accomplished with Airco's circle cutting attachment. Its range includes 1" through 26" diameter circles. The attachment consists of a center point radius rod and a slotted brass clamp which fastens over the torch head.

Order 831-3100 for 9000 and 9500 series straight head torches or 831-3099 for all Airco machine cutting torches.



Circular Cutting Attachment

Torch Inlet-Pressure Test Gauges — When setting up to use multiflame heating tips, pressure test gauges are a must for efficient torch operation. Test gauges indicate gas pressure at torch inlet valves and reduce the time required to trouble-shoot gas supply problems.

These gauges are particularly helpful when using large multiflame heating or descaling tips where gas supply problems mean trouble. Simply attach these gauges between the supply hoses and torch. All fittings are "B" size.

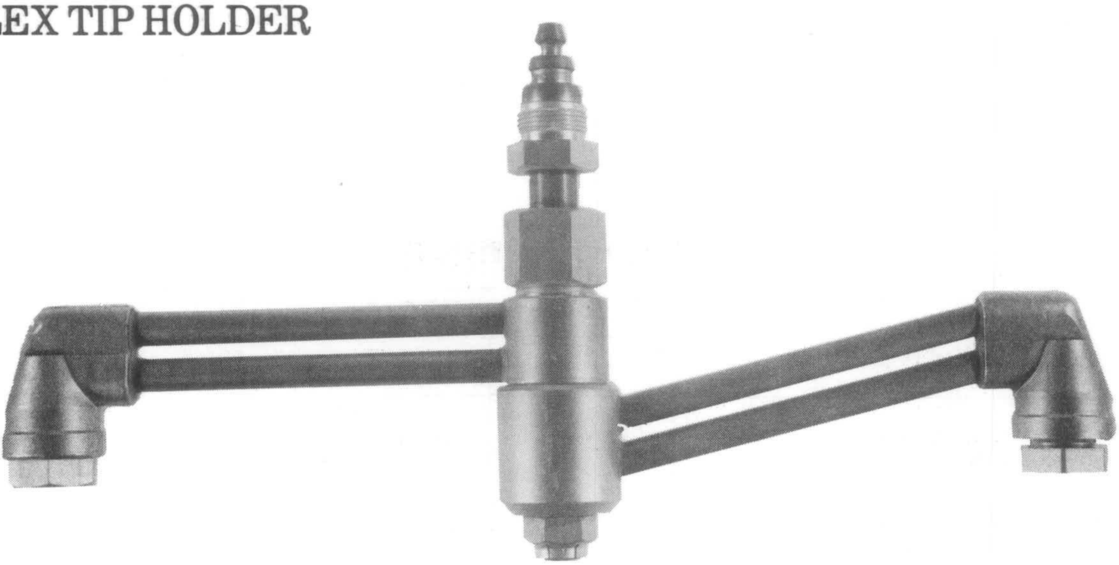
831-2840 For Oxygen 831-2841 For Fuel Gas

Torch Inlet Pressure Test Gauge

6. DUPLEX TIP HOLDER

The Adjustable Duplex Tip Holder permits 2 parallel cuts to be made simultaneously with one Airco cutting torch. When this versatile tool is used with the number 10A Radiagraph, concentric circles can be cut in one pass. Duplicate cuts can be accomplished by using this attachment with cutting machines. Easily adjusted to cut metal strips between 1-1/4" and 12" wide (3.2 & 30.5 cm.) it can be used for work to 3" (7.6 cm) plate thickness. Since two cuts are made simultaneously, total cutting time and related expense are reduced by 50%.

DUPLEX TIP HOLDER



HOW TO ORDER

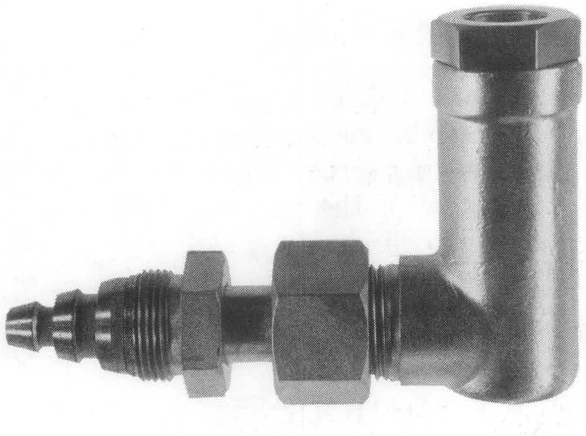
Stock Number	Torch Used With	Fuel Gas	Parts List
831-2925	4700 Series	Med. Pressure MAPP® Gas (MPS), Acetylene, Propane or Nat. Gas	ADI 1762
	2600 Series	Low Pressure Natural Gas	

FIXED-ANGLE TORCH HEADS

Whether the production runs are large or small, fixed angle torch heads provide versatility, accuracy, and efficient performance when bevel cutting, nippling flanges, notching or splitting webbs.

Changing from one angle to another may be accomplished in minutes, by simply changing the head without the need to reposition the plate or the torch.

Torch heads are available in four different angles: 90°, 60°, 45°, and 30°.



HOW TO ORDER

Using AIRCO Torch	Order Fixed Angle Torch Head			
	90°	60°	45°	30°
4700 Series (Tip Mixing Type)	831-0722	831-0748	831-0749	831-0750
2600 Series (Pre-Mixed Type)	831-2806	831-2807	831-2808	831-2809

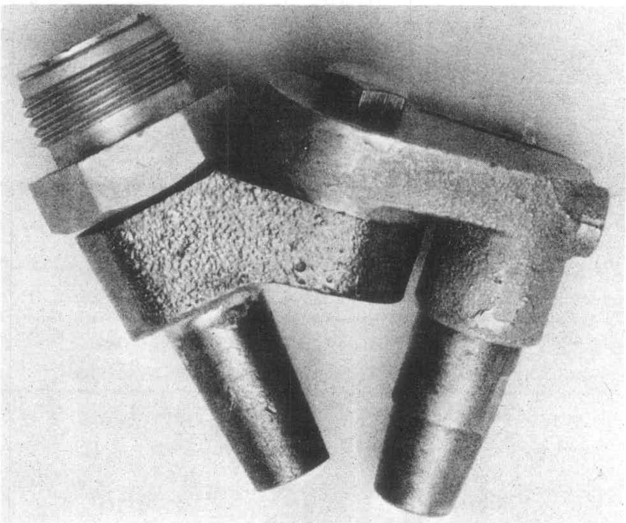
7. PREHEAT BEVELING ADAPTER

813-2663

When a cutting torch is used for bevel cutting, the glancing angle at which the preheat flames strike the work causes a considerable loss of heat input efficiency. To offset this loss of heat, an Airco Preheat Bevel Adapter is recommended. This adapter incorporates an offset preheat nozzle which applies a portion of the preheat in advance of the cutting tip. The offset nozzle remains perpendicular to the work surface, regardless of the bevel angle. This type of tip design also enables an increase in bevel cutting speed. Adapters are only required for propane or natural gas.

The adapter is not supplied with a cutting tip insert. Tip inserts for the proper bevel widths must be ordered as required from the style 263 and 363 cutting chart. The largest insert which can be used in the style 263 is a size 5. The largest insert which can be used in the style 363 is a size 4.

This adapter is used for cutting right or left hand bavels.



HOW TO ORDER INSERTS

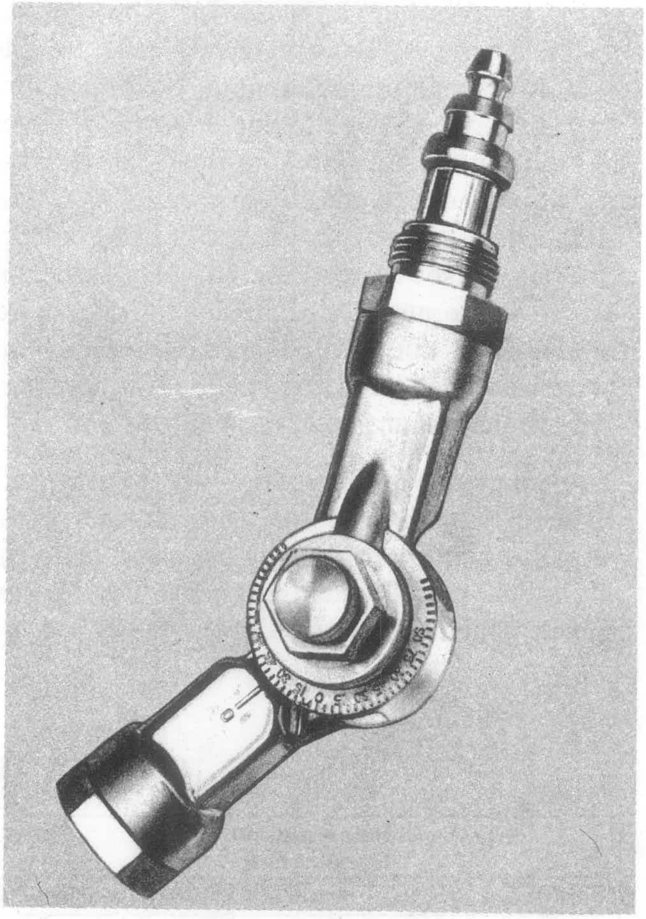
Style 263 Straight-Bore Tips			Style 363 Divergent-Type Tips		
Plate Thickness, Inches	Tip No.	Insert Assembly Stock No.	Plate Thickness, Inches	Tip No.	Insert Assembly Stock No.
Up to 1/2	0	813-2048	Up to 1/2	1	813-1975
1/2 – 3/4	1	813-1983	1/2 – 1	2	813-1976
3/4 – 2	2	813-1984	1 – 2	3	813-1977
2 – 3	3	813-1985	2 – 3	4	813-1978

For Parts and Instructions Refer to ADI 1729

ADJUSTABLE ANGULAR TORCH HEADS

The Airco Adjustable Angular Torch Heads permit bevel and straight line cutting without the need to angle the torch. Total angular adjustment on either side of the vertical plane is 125°. The additional 35° from the horizontal enables cutting from below the work level when necessary. Indexing marks of 5° increments are forged in the face of the adapter body to facilitate adjustment at any required degree. Tip sizes to number 6 can be used with this attachment.

Using Airco Torch	Order Adjustable Angular Torch Head
4700 Series (Tip Mixing Type)	831-2100
2600 Series (Pre-Mixed Type)	831-2810



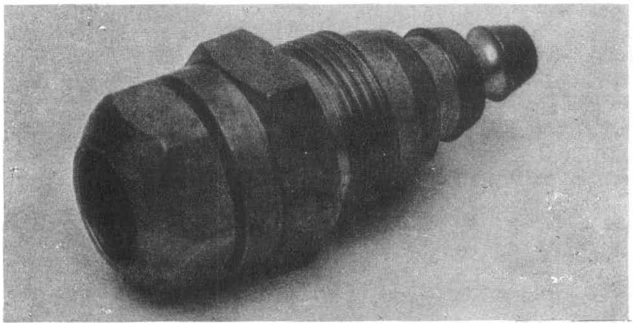
MASTER TIP SEAT BLOCKS

Master Tip Seat Blocks enable users of Airco or competitive cutting torches to benefit from the economies of using Master Cutting Tips. Once installed in the torch head, the Block serves as a seating surface for any of the Master Tips. Torch head maintenance is practically eliminated. For details on Master Tips and Seat Blocks for competitive torches refer to Catalog 813.

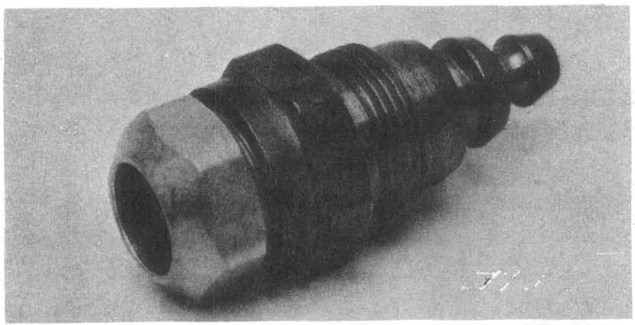
SEAT BLOCKS FOR AIRCO TORCHES

Use 831-2873 Seat Block with Airco positive pressure torches using medium pressure MAPP Gas, Propane or Natural Gas with Master Tips. This Block is used with Airco 1100, 3000, 9000 and 9500 Series hand torches or 4700 machine torches. It can also be used with Series 3700, 4700 or 4800 Cutting Attachments. 831-2904 Seat Block converts the positive pressure torches listed above into effective injector torches.

831-2903 Seat Block is used with Style 2600 machine torches or Style 2900 hand torches for injector (low-pressure) operation. These Seat Blocks are supplied with Tip Nut 831-2870.



831-2873

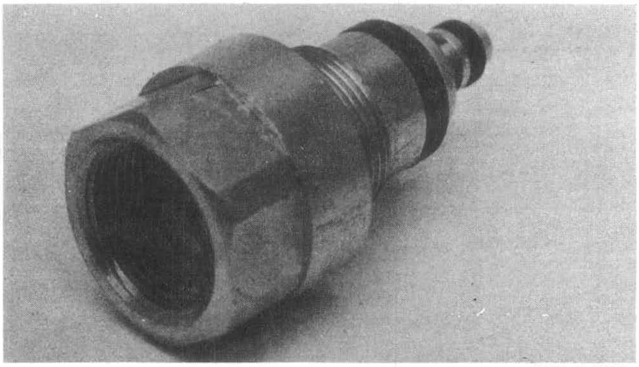


831-2904

Converts Positive Pressure Torch to Injector Torch

ADAPTER ASSEMBLY 831-2637

With this Adapter you can use Airco Hard Seat, 3/4" 3 land tips with discontinued Styles 2000 and 2500 soft seat torches. Replacement insert rubber rings are 813-1506 (small) and 813-1507 (large).

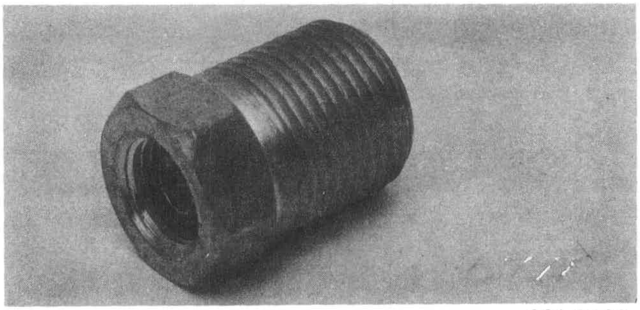


831-2637

Adapter Assembly

OXYGEN "B" to "C" ADAPTER

Adapter Assembly 831-2130 is used to enable hose lines and accessories equipped with Class "C" 7/8-14 (R.H.) nut and gland fittings to be connected to apparatus having Class "B" 9/16-18 (R.H.) male connection nipple. The assembly is particularly useful in adapting "B" size torch oxygen fittings to "C" size hose fittings.



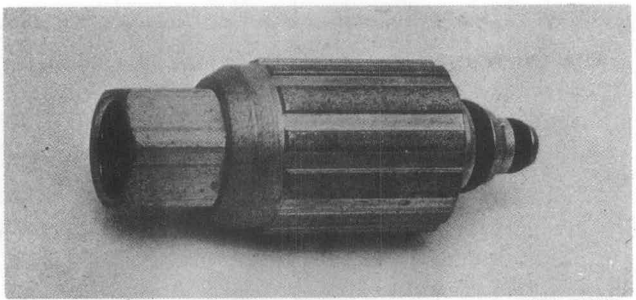
831-2130

WELDING TORCH ADAPTERS

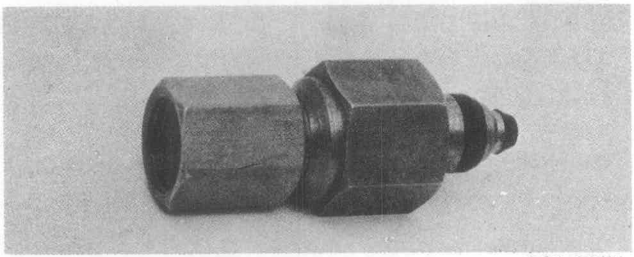
Adapters permit the use of RAM-JET® High Velocity Brazing Tips, and conventional* gas-air brazing and soldering equipment in Airco Welding Torches. Simply remove welding tip mixer from the torch and replace with an adapter and the desired gas-air tip or accessory. This tool eliminates the need for additional brazing equipment.

For Airco Style 750 Torch order 831-2950
For Style 300 or 400 Torch order 831-2951

*Conventional — POL TYPE Seat (1/2-20 thread)



831-2950



831-2951

LESSON PLAN

SUBJECT: SECTION J: PROPORTIONERS

OBJECTIVE: To present the various type of proportioners as gas mixing systems.

REFERENCE: Product Information Class 8 Text
Section J: Proportioners

TRAINING
MATERIALS: Product Information
Class 8 Text
Section J: Proportioners

PRESENTATION:

I. Gas Proportioners
  - A. A gas-mixing device which automatically mixes two or more gases and delivers them at a desired flow rate in accurate proportions.
    - 1. "Demand-Type"—self adjusting to varying requirements. Airco markets 3 models.

REFER TO CATALOG SHEET AT END OF SECTION.

- a. Mini Proportioner — portable, blending 2 or 3 gases. Ideal for inert gas welding, atmospheres and other commercial applications.
  - 1. Flow capabilities to 200 cfh
  - 2. Four station manifold permits up to four operators.
  - 3. Each operator uses up to 50 cfh in exact proportions.

REFER TO CATALOG SHEET AT END OF SECTION.

- b. 1000 cfh Gas Proportioner — designed to deliver a mixture of two gases at fixed proportions over a flow range to 100 cfh without need for corrective adjustment.
  - 1. Used for piping into a shop gas supply system or direct use from the proportioner.

REFER TO CATALOG SHEET AT END OF SECTION.

- c. 6000 cfh Gas Proportioner — designed for high-production requirements over a flow range to 6000 cfh.
  - 1. Only used for piping into a shop gas supply system.

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION J
PROPORTIONERS

1. Mini Proportioner

2. Large Proportioners

GAS PROPORTIONERS

It is not uncommon for a user of industrial gases to want to "mix his own".

A gas proportioner is a gas-mixing device that automatically mixes two or more gases and delivers them at a desired flow rate, in accurate proportions for a specific application. Flow rates from a proportioner are controlled and measured either with flow meters, or orifice settings inside the proportioner equipment.

A proportioner that is self-adjusting to varying requirements is called a "demand-type". Airco markets three demand-type proportioner models: 1) 200 cfh; 2) 1000 cfh; and, 6000 cfh. Each model is used in a broad spectrum of industrial applications, including: electronics, research, and welding. The 200 cfh model is most frequently used to provide gas mixtures for gas metal arc welding (GMAW or MIG).

In an Airco demand-type proportioner, incoming gases are mixed, then fed into a reservoir (tank) which is part of the proportioner. The mixing system is independent of the demand reservoir, which avoids altering the gas ratios if sudden demand surges occur.

The following pages contain catalogs on each of Airco's proportioners. Study the information thoroughly. The successful application of a proportioner provides a happy customer, one who is saving money by "mixing his own", to the proportions required by his own operations. No doubt he'll also be buying the gases from you.

AIRCO®

Mini-Proportioner™

805 2000 for 2 Gas Mixtures
805 2001 for 3 Gas Mixtures

A Portable, Extremely Accurate Gas Mixing System

The **MINI-PROPORTIONER**™ is a portable, extremely accurate gas mixing system. Used to blend two or three gases in exact proportions, it is ideal for inert gas welding, atmospheres (forming gas mixtures), generator cooling and other commercial applications.

The **MINI PROPORTIONER** has important features found only in very expensive stationary proportioners. It is a demand type proportioner with built in mixed gas reservoir and regulator to maintain constant pressure and flow of mixed gas to the work station. High flow capabilities to 200 SCFH and a four station manifold permits up to four operators to use the proportioner simultaneously.

This proportioner is easy to use. Simply connect to gas supply, set supply regulators to 75 psi and the proportioner does the rest. This unit has no electrical requirements, weighs only 30 pounds and can be used anywhere.

FEATURES	BENEFITS
● **EXTREMELY ACCURATE** ± 0.5% of exact mixture.	**ACCURATE GAS MIXTURES** for protective welding atmospheres.
● Each unit is factory set to meet user's requirements.	**TAMPER PROOF** — Operator cannot inadvertantly change gas mixture.
● **SIMPLE TO USE**	**MINIMUM SET UP TIME**
● **CONSTANT DELIVERY PRESSURE** is maintained by a built in regulator. Set @ 15 or 30 PSIG.	
CAPABLE OF 2 OR 3 GAS MIXTURES IN ANY PROPORTION — Gases include Argon, CO_2, Oxygen, Nitrogen, & Helium. Forming gas mixture of Nitrogen and Hydrogen may be made if special precautions recommended by mfg. are followed (See ADI 1763, Section II).	**VERSATILE** **ELIMINATES THE NEED TO BUY PRE MIXED GAS**
● **ECONOMICAL** ● **WEIGHS ONLY** 30 pounds	**PORTABLE** — easily carried and used anywhere
● **A UNIQUE MECHANICAL CYCLER** precisely controls mixing.	**NO ELECTRICAL REQUIREMENTS** **MINIMUM MAINTENANCE** — no solenoids to replace
DEMAND PROPORTIONER utilizes a mixed gas reservoir with safety relief valve.	**SAFETY** — INTERNAL PRESSURE PROTECTION
MANIFOLD HAS 4 OUTLETS	As many as 4 operators can use the **MINI PROPORTIONER** at once.
HIGH GAS FLOW CAPABILITY — to 200 SCFH	For increased capacity two or more **MINI PROPORTIONERS MAY BE** used in parallel

For Instructions & Parts See ADI 1763

OCTOBER 1973
SUPERSEDES APRIL 1973

SPECIFICATIONS:

Inlet Connections:

Major Gas — ⅝ - 18 R.H. Internal
Minor Gas — ⅝ - 18 R.H. External for CO , Argon,
Helium or Nitrogen
— 9/16 - 18 R.H. Internal for Oxygen
— 9/16 - 18 L.H. Internal for Hydrogen

Outlet Manifold has 4 ea. ¼" N.P.T. Internal Threads
2 Plugged
2 Valves with ⅝ - 18 R.H.
Internal Threads

Delivery Pressure 15 or 30 psi (preset)
Inlet Pressure 75 - 100 psi depends on outlet pressure
Max. Flow 160 - 400 S.C.F.H. (most mixtures 200 S.C.F.H.)

HOW TO ORDER

First — Specify the stock number of the appropriate proportioner

805 - 2000 mini proportioner for mixing 2 gases

805 - 2001 mini proportioner for mixing 3 gases

Second — Specify the gases to be mixed and the mixture by percent of each gas.

Third — Specify delivery pressure requirements

NOTE: The proportioner is factory set to deliver @ 15 PSIG unless otherwise specified.

EQUIPMENT REQUIRED FOR ACCURATE CONTROL.

Regulators — The mini proportioner is calibrated @ 75 PSIG inlet pressure. Two stage regulators with delivery capability of 75 PSIG are recommended. Airco regulators are listed below:

CYLINDER REGULATORS:

Gas Service	Stock No.	2-1/2" PSI Pressure Gauges	Max. Flow CFH	Max. Work Pressure PSI	Connections		
					CGA No.	Inlet	Outlet
CO_2 *	806 8007	200 & 2000	135	100	320	.830 - 14 R.H. Int.	"B" 5/8 -18 R.H. Int.
Argon Nitrogen	806 8420	200 & 4000	975	100	540	.908 - 14 R.H. Int.	"B" 5/8 -18 R.H. Int.
Argon Helium Nitrogen	806 9402	200 & 4000	975	100	580	.960 - 14 R.H. Ext.	"B" 5/8 -18 R.H. Int.
Nitrogen	806 8427	200 & 4000	975	100	550	.908 - 14 L.H. Int.	"B" 5/8 -18 R.H. Int.
Hydrogen	806 9453	200 & 4000	975	100	350	.830 - 14 L.H. Int.	"B" 9/16-18 L.H. Ext.
Oxygen	806 8456	200 & 4000	975	100	540	.908 - 14 R.H. Int.	"B" 9/16-18 R.H. Ext.
Helium	806 9458	200 & 4000	975	100	350	.830 - 14 L.H. Int.	"B" 5/8 -18 R.H. Int.

*806 8007 is an electrically heated CO_2 regulator.

FLOW CONTROL EQUIPMENT:

To fully benefit from the economies resulting from proportioning gases, flow control equipment should be used. Airco general purpose (universal) flowmeters are listed for your convenience

Fixed flow adapters are also available for use where optimum constant flow rates are known.

See ADI 1763 for details.

UNIVERSAL FLOWMETERS

STOCK NO.	DESCRIPTION	FLOW RANGE (S.C.F.H. AIR)	
801 0430	Single Range General Purpose Flowmeter		3-56 @ 15 PSIG 4-68 @ 30 PSIG
805 1606	Dual Range General Purpose Flowmeter	Low Scale	2-23 @ 15 PSIG 2-28 @ 30 PSIG
		High Scale	30-180 @ 15 PSIG 35-220 @ 30 PSIG

For further information, call your local AIRCO Distributor listed in the Yellow Pages under "Welding Equipment & Supplies"

AIRCO Welding Products

A Division of Airco, Inc., P.O. Box 486, Union, New Jersey 07083
Offices & Distributors in Principal Cities • Airco International Dept.

Printed In U.S.A.

11-75-5M-630

1000 CFH GAS PROPORTIONER
VARIABLE MIXTURE

APPLICATIONS

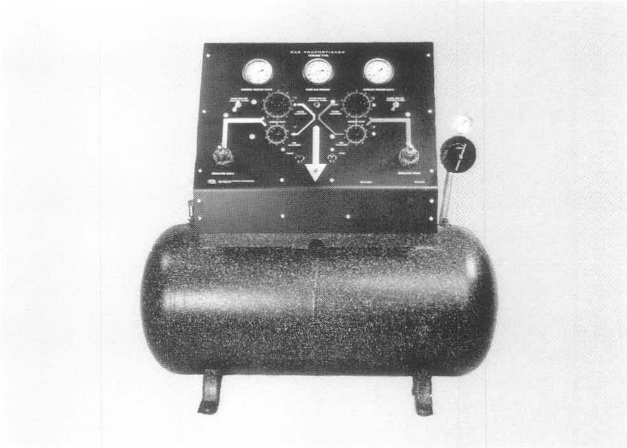
The Airco 1000 cubic-foot-per-hour (CFH) Gas Proportioner is a compact, demand-type gas mixing unit, designed to deliver a continuous supply of any two non-explosive or non-corrosive gases in specified proportions, which may be varied according to the user's requirements. It permits mixing gases for production needs for piping into a shop gas supply system, or for direct use from the proportioner. Mixtures that may be obtained range from 100/0 to 50/50 of nitrogen, oxygen, argon, carbon dioxide, hydrogen, helium, or any two gases, except for a mixture of hydrogen with oxygen or a similar combustible mixture.

Typical uses include:

- Welding—shield gas (MIG and TIG).
  - Typical: AG25, AG75, argon-oxygen, helium-hydrogen.
- Atmospheres—furnace, blanketing.
  - Typical: forming gases (hydrogen & nitrogen), hydrogen-argon, CO-N$_2$.
- Incandescent lights.
  - Typical: argon-nitrogen, argon-neon.
- Generator cooling.
  - Typical: CO$_2$-H$_2$.
- Chemical and process—various mixtures.

FEATURES

- Two or more gas proportioners can be connected in parallel to form multiple-unit installations for higher flow rates.
- Two or more proportioners can be connected in parallel with tanks interconnected to form a common tank to mix three, four, or more gases.
- Adjustment of variable gas-mixture proportions is maintained by two sets of dials, each having a coarse and fine metering valve to provide close control of any mixture.
- Handles any non-explosive or non-corrosive gas mixture.
- Range of mixture proportions ranges from 100/0 to 50/50.
- Can be installed indoors or out, with proper precautions.
- If either gas supply line fails, the electrical system will shut down automatically, thereby stopping the proportioner until gas failure has been corrected.
- Not sensitive to leveling. Can operate "as installed."
- Mixer console is detachable as a unit from tank.



DESCRIPTION

The Airco 1000 cfh Gas Proportioner is designed to deliver a gas mixture of fixed proportions that can be maintained over a flow range of 0 to 1000 cfh without need for corrective adjustment. Gases can be mixed to the proportion wanted with high accuracy, which is not affected by the flow rate.

Mixer variability is accomplished by two sets of dials, adjusted according to mixture requirements and predetermined tabular data. A coarse and fine metering valve in each set of dials provides close control of any gas mixture. Low cycling frequency of the Console extends the life of moving parts such as regulators, solenoid valves, and pressure switches. Only those devices essential to safe and selective mixing of gases are incorporated in the Console.

The proportioner can be used as a single unit, or two or more can be interconnected to cycle simultaneously by joining their electrical systems with a jumper. For multiple-unit use, gas analyzing equipment and a manifolding system are employed for the outlet gas. Any external piping, controls, manifolding and regulation equipment desired is the responsibility of the user.

Specifically designed for mixing two gases, the unit has a mixed-gas output up to 1000 cfh at up to 30 psi. When hydrogen or any combustible gas component is used as one of the two gas components, the electrical classification of the proportioner is Class 8, Division 2, National Electrical Code for Hazardous Locations.

Gas supply inlet pressures from 80 to 150 psi must be available to the proportioner.

Regulators and Solenoid Valves are U.L. Listed.

Basic parts of the proportioner are tank and mixer console.

The tank, made to ASME-UPV (Unfired Pressure Vessel) Code requirements, has a volume of 8 cubic feet, and is equipped with a preset relief valve. The tank legs contain bolt holes for mounting securely to prevent any shifting that might lead to piping leaks. Installations may be made with flexible gas lines such as hose.

The Mixer Console contains all of the operating devices, and weighs approximately 110 pounds. Aids and controls are on the exterior sloping face of the unit. The Console may be mounted on any tank able to support the console frame. It can also be mounted on a bench or shelf with a hose run to a tank in a remote location.

The working elements of the gas flow system are inside the console. These respond to the "demand" of the system, provide the desired mixture, and react to a shut-down if the gas supply fails. The console shields against ordinary environment.

ACCESSORIES

With multiple units, for increased output, interconnecting piping and isolating valves can be installed by the user to accommodate his physical arrangement. Likewise, the interconnecting, single-wire electrical jumper can be installed by the user to permit the multiple units to perform as one—delivering a volume of mixed gases up to the sum of the individual unit capacities.

With multiple consoles or tanks for additional output, the user can utilize standard 1/2 inch hose and C size fitting with electrical connections, tanks, and pipes to suit.

The single unit comes ready to use upon installation. If the user wishes special controls, they can be installed by him as accessories without affecting the proportioner. For example, a power-failure lock-out solenoid can be located in either the inlet or outlet gas system away from the proportioner, and a mixture monitor such as a gas analyzer can be independently connected into the solenoids.

SPECIFICATIONS

Mixed-gas output — any gas combination	1000 cfh up to 30 psi
Mixed-gas output — lighter density gases	Up to 2000 cfh at up to 30 psi
Tank Volume	8 cf
Electric current requirements	30 watts at 110 volts AC
Approximate weight of proportioner	300 lbs.
Height	3 ft. 10 in.
Width	4 ft.
Depth	2 ft.

HOW TO ORDER

First — Specify the two gases.
Second — Specify the gas mixture by percent.
Third — Specify available gas pressures at proportioner inlet, and delivery pressure required from proportioner.
Fourth — Special instructions—such as packaging.

Description	Stock Number
1000-cfh Gas Proportioner for use with any two gases except acetylene, hydrogen or other combustible gas with oxygen.	805-1725

OPTIONAL ACCESSORIES

(For multiple unit installations)

Electrical Jumper — single conductor between terminals, according to wiring and conduit used by customer and installed by him. Electrical switch, which must be included in jumper line, may be located on control box or on conduit, according to customer's discretion and installation.

Description	Stock Number
Non-return valve for isolating mixer consoles and tanks*	801-8000

* Quantity required is according to installation selected by customer from multiple-unit Schematic diagram in ADI 1441A.

OPTIONAL ACCESSORIES

Gas Analyzers are accessory items which are the responsibility of the customer.

For further information, call your local AIRCO Distributor listed in the Yellow Pages
under "Welding Equipment & Supplies"

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Printed in U.S.A.

6-76-10M-247

AIRCO®

6000-CFH GAS PROPORTIONER

For continuous preparation of accurate gas mixtures

APPLICATION

Designed for high-production requirements, the Airco 6000-cfh (cubic feet/hour) gas proportioner is a demand-type gas-mixing unit that mixes gases in the proportions required for production needs, for piping into a shop gas-supply system. The unit is factory set to deliver a continuous supply of any two non-explosive or non-corrosive gases in accurate, specified proportions and without need for any corrective adjustment.

Mixtures obtained may range from 100/0 to 50/50 of nitrogen, oxygen, argon, carbon dioxide, hydrogen, helium or any two gases, except for a mixture of hydrogen with oxygen or a similar combustible mixture. Typical uses include:

Welding—shielding gas (MIG and TIG). Typical: AG 25, AG 75, argon-oxygen, helium-hydrogen.

Atmospheres—furnace, blanketing. Typical: forming gases (hydrogen and nitrogen), hydrogen-argon, CO-N_2.

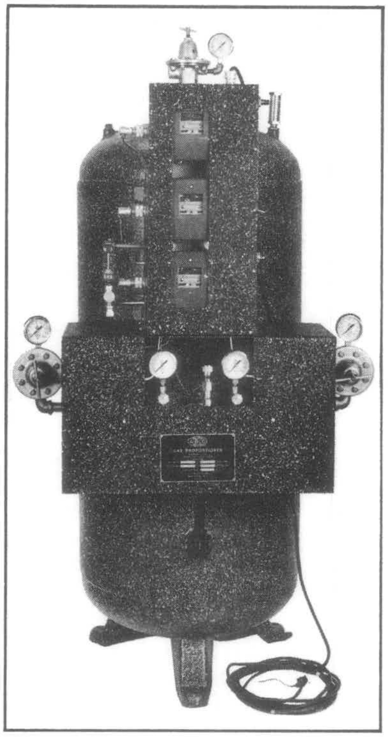
Incandescent lights—Typical: argon-nitrogen, argon-neon.

Generator cooling—Typical: CO_2-H_2.

Chemical and process—various mixtures.

FEATURES

- Delivers any mixture ratio from 100/0 to 50/50 over a flow range of 0 to 6000 cfh at 30 to 60 psi.
- For higher flow rates, two or more units can be interconnected to increase output to 12,000, 18,000, 24,000 or more cubic feet per hour.
- Accuracy of ±1%, regardless of flow rate, is maintained by finely machined, calibrated and preset metering orifices designed by Airco.
- Unit can be installed either indoors or out, with proper precautions.
- "Fail-safe" devices in the electrical system automatically shut down gas flow if either gas supply fails.
- Ruggedly built, compact and integral unit.



DESCRIPTION

The Airco 6000-cfh gas proportioner can be used as a single unit, or two or more can be interconnected to cycle simultaneously by joining their electrical systems with a jumper. For multiple-unit use, gas analyzing equipment and a manifolding system are employed for the outlet gas. Any external piping, controls, manifolding and regulating equipment are the responsibility of the user. When hydrogen or any combustible gas component is used as one of the two gas components, the electrical classification of the proportioner is Class 1, Division 2, National Electrical Code for Hazardous Locations.

Basic parts of the proportioner are the tank, control box, and gas manifold.

Tank

Made to ASME-UPV (Unfired Pressure Vessel) Code requirements, the tank has a volume of 12 cubic feet and is equipped with a preset relief valve. The tank legs have bolt holes for mounting securely to prevent any shifting that might lead to piping leaks. For temporary installations with flexible gas lines such as hose, the unit can be level and free-standing.

Control Box

All the proportioner's electrical switches are contained in the control box, including two pressure switches that "fail safe" to shut down gas flow if one gas supply fails. Switches are housed in a metal box to protect them against dirt and surrounding environment. When one gas is combustible, the box is charged from the non-combustible gas line to hold it under an inert atmosphere.

Gas Manifold Assembly

This contains the working elements of the gas flow system, which respond to the "demand" of the system, provide the desired mixture, and react to "fail-safe" shutdown if the gas supply fails. The manifold, shielded against ordinary environment, can easily be fitted with additional shielding against personnel who might tamper with the controls.

MAY 1966
SUPERSEDES APRIL 1965
PAGES 6.10, 6.11, & 6.12

6000-CFH GAS PROPORTIONER

For continuous preparation of accurate gas mixtures

ACCESSORIES

The single unit comes ready to use upon installation. If special controls are desired, they can be installed by the user as accessories without affecting the proportioner. For example, a power-failure lock-out solenoid can be located in either the inlet or outlet gas system away from the proportioner, and a mixture monitor such as a gas analyzer independently connected into the solenoids. With multiple units, interconnecting piping and isolating valves can be installed by the user to conform to his physical arrangement. In the same way, the interconnecting, single-wire electrical jumper can be installed by the user. This will permit the multiple units to perform as one—delivering a volume of mixed gases up to the sum of the individual unit capacities.

A higher-capacity regulator with strainer (Stock No. 806-0006) may be substituted by the user for the regulator normally furnished.

For operating instructions and parts, see ADI-1434.

SPECIFICATIONS

Mixed-gas output	Up to 6000 cfh at 30 to 60 psi
Tank volume	12 cf
Power requirements	30 watts at 110 volts AC
Approximate weight	600 lbs.
Height	5 ft. 8¼ in.
Width	3 ft. 2½ in.
Depth	2 ft. 9⅜ in.

HOW TO ORDER

First, specify the two gases. *Second,* specify gas mixture by percent. *Third,* specify available gas pressures at proportioner inlet, and delivery pressure required from proportioner. *Fourth,* Note special instructions, such as packaging. *Fifth,* if one gas is combustible (hydrogen), order 805-1750; otherwise order 805-1751.

Description	Stock No.
6000-cfh Gas Proportioner for use with a combustible (i.e., hydrogen) gas component as one gas in the mixture	805-1750
6000-cfh Gas Proportioner for use with non-combustible gases	805-1751

ACCESSORIES

(for multiple-unit installations)

Electrical Jumper, single conductor between terminals, according to wiring and conduit used by customer and installed by him.

Electrical Switch, which must be included in jumper line, may be located on control box or on conduit, according to customer's discretion and installation.

Description	Stock No.
Non-return valve for isolating regulators on tanks*	801-0171
Regulator (alternate for regulator 806-8791 supplied) to furnish straight-through piping and cleanable filter*	806-0006

*Quantity required is according to installation selected by customer from multiple-unit schematic diagram in ADI-1434, Page 4.

For further information, call your local AIRCO Distributor listed in the Yellow Pages under "Welding Equipment & Supplies"

AIRCO Welding Products
A Division of Airco, Inc., P.O. Box 486, Union, New Jersey 07083
Offices & Distributors in Principal Cities
Airco International Department, P.O. Box 281, Union, New Jersey 07083

LESSON PLAN

SUBJECT:	SECTION K: SMALL MACHINES
OBJECTIVE:	To familiarize the participant with small, portable flame cutting machines and supporting equipment.
REFERENCES:	Product Information Class 8 Text SECTION K: SMALL MACHINES
TRAINING MATERIALS:	Product Information Class 8 Text Section K: Small Machines.

PRESENTATION:

REFER TO CATALOG SHEETS IN TEXT MATERIAL

SECTION K: SMALL MACHINES
- RADIAGRAPHS 10, 16, AND 20
- CAMOGRAPH
- PIPE BEVELING MACHINE
- TENSILE TESTING MACHINE

I. RADIAGRAPHS Models 10, 16, 20

A. The need for accurate flame cutting has resulted in the development of these rugged machines to perform cutting tasks. They range from the relatively simple RADIAGRAPHS to the highly sophisticated SERVOGRAPHS.

1. RADIAGRAPHS 10A and 16A.
   - a. Portable machine that cuts straight lines of any length with either square or beveled edge.
   - b. They are the standard for durability in the industry and reliable for highly accurate cutting. Designed for straight line, curves, or circle cutting.
   - c. No. 10A and 16A are similar except for speeds:
     1. 10A for speeds of 4 to 50 I.P.M.. Cutting plate up to 8" thick.
     2. 16A for speeds of 2 to 28 I.P.M. Cutting plate from 6 to 15" thick.
2. RADIAGRAPH 20
   - a. A heavy-duty portable flame cutting machine.
   - b. Two-speed ranges.
   - c. Wide range of accessories permit use on many different applications:
     - Plasma Cutting
     - Automatic Arc Welding
     - Flame Hardening

II. 42 CAMOGRAPH

A. Shape cutting machine for accurate, repetitive production. With a suitable cam, it will automatically cut identical shapes from steel plate.

B. Can cut practically any shape in a 42 inch diameter circle.

C. A hinged swinging arm type machine. An arm assembly pivots at its support and at its center.

III. Pipe Cutting and Beveling Machine
  A. Cut or bend pipe from 4" to 12" in diameter.
  B. Links can be added to extend the diameter to 36".
  C. The machine, hand powered, on four wheels, moves an oxy-fuel cutting torch around the outer wall of a pipe.

IV. Tensile Testing Machine
  A. To test the strength of welds.
  B. Because it is portable, it can be brought to the job site to test welds and qualify welders.
  C. Can perform guided bend tests and tension tests.

PRODUCT INFORMATION
CLASS 8
TEXT MATERIAL

SECTION K
SMALL MACHINES

1. RADIAGRAPHS® 10, 16, and 20
2. CAMOGRAPH®
3. Pipe Beveling Machine
4. Tensile Testing Machine

SMALL MACHINES

The application of this Class 8 Program knowledge extends beyond the basic torch, regulator and accessories previously discussed, to what we refer to as the area of Small Machines. This product line consists of: the Pipe Cutting and Beveling Machine; the Radiagraph Cutting Machine; the Camograph Cutting Machine; Powder Cutting Equipment; and, the Tensile Testing Machine.

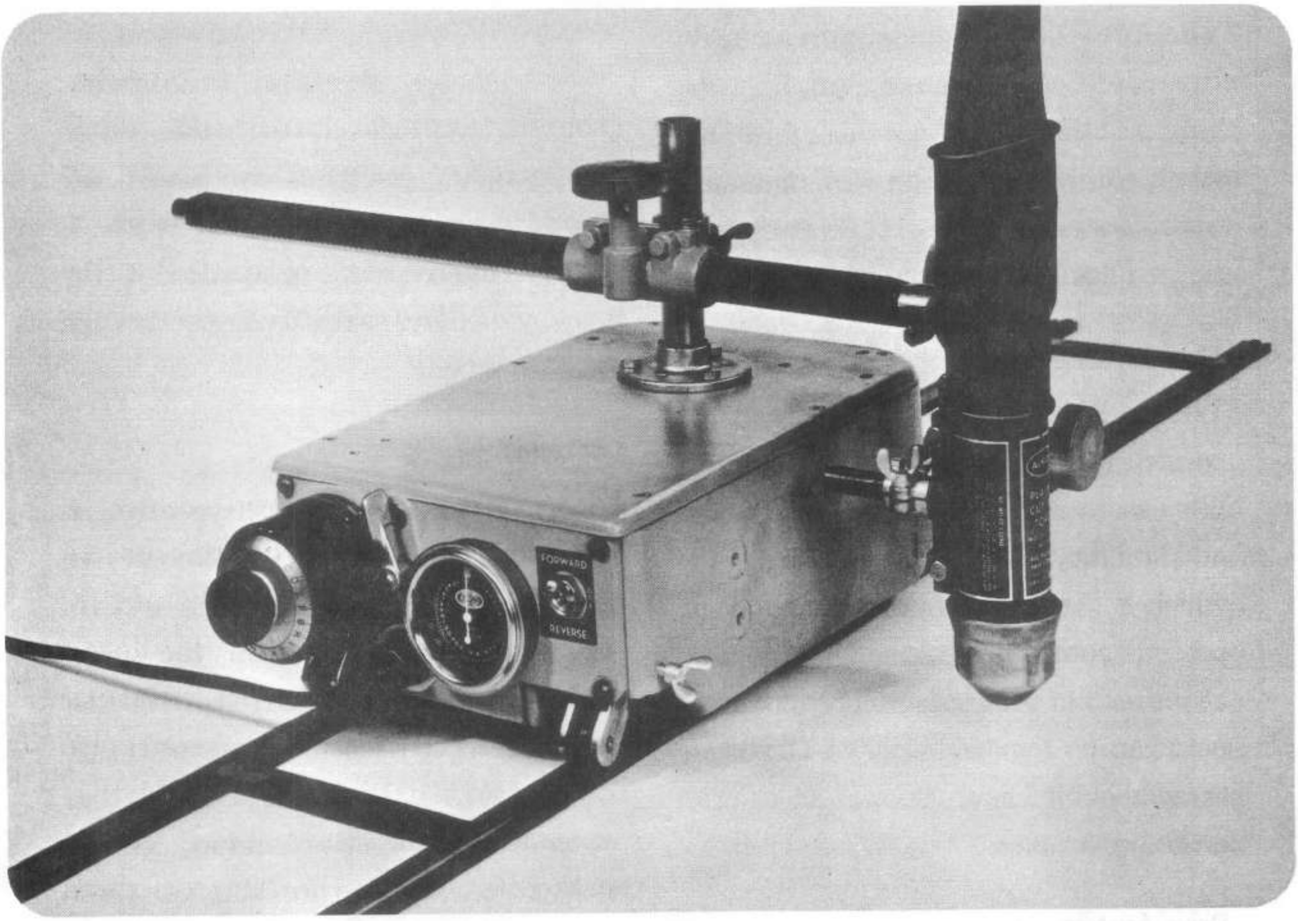
Catalogs are provided in this Section on each of these Machines. It is important that you become familiar with where these machines are used in industry. In most cases they can be considered as labor saving units that fill a specific need. It is not unusual to find industries using some of these smaller machines, while also using much more sophisticated ones.

Cat 804
Page 2.1 – 2.8

No 10A + 16A RADIAGRAPH

AIRCO

No.20 Radiagraph



FEATURES

PORTABLE **EFFICIENT**

ACCURATE **RELIABLE**

VERSATILE **RUGGED**

APPLICATIONS

PRECISION FLAME CUTTING

PLASMA CUTTING

AUTOMATIC ARC WELDING

FLAME HARDENING

Supersedes October 1961, Pages 81 to 94

General

The Airco No. 20 Radiagraph is a heavy duty, precision engineered, portable cutting machine. The basic design of the machine in combination with the many accessories available provides nearly unlimited flexibility of application.

Machine Carriage

The No. 20 Radiagraph machine carriage consists of a rugged, one-piece aluminum alloy casting of ideal size for convenience and stability. The cover is a flat plate to which is attached a standard mounting post; all controls are conveniently placed at the ends of the carriage. The mounting post can be removed easily to facilitate attachment of large, special accessories on the cover plate.

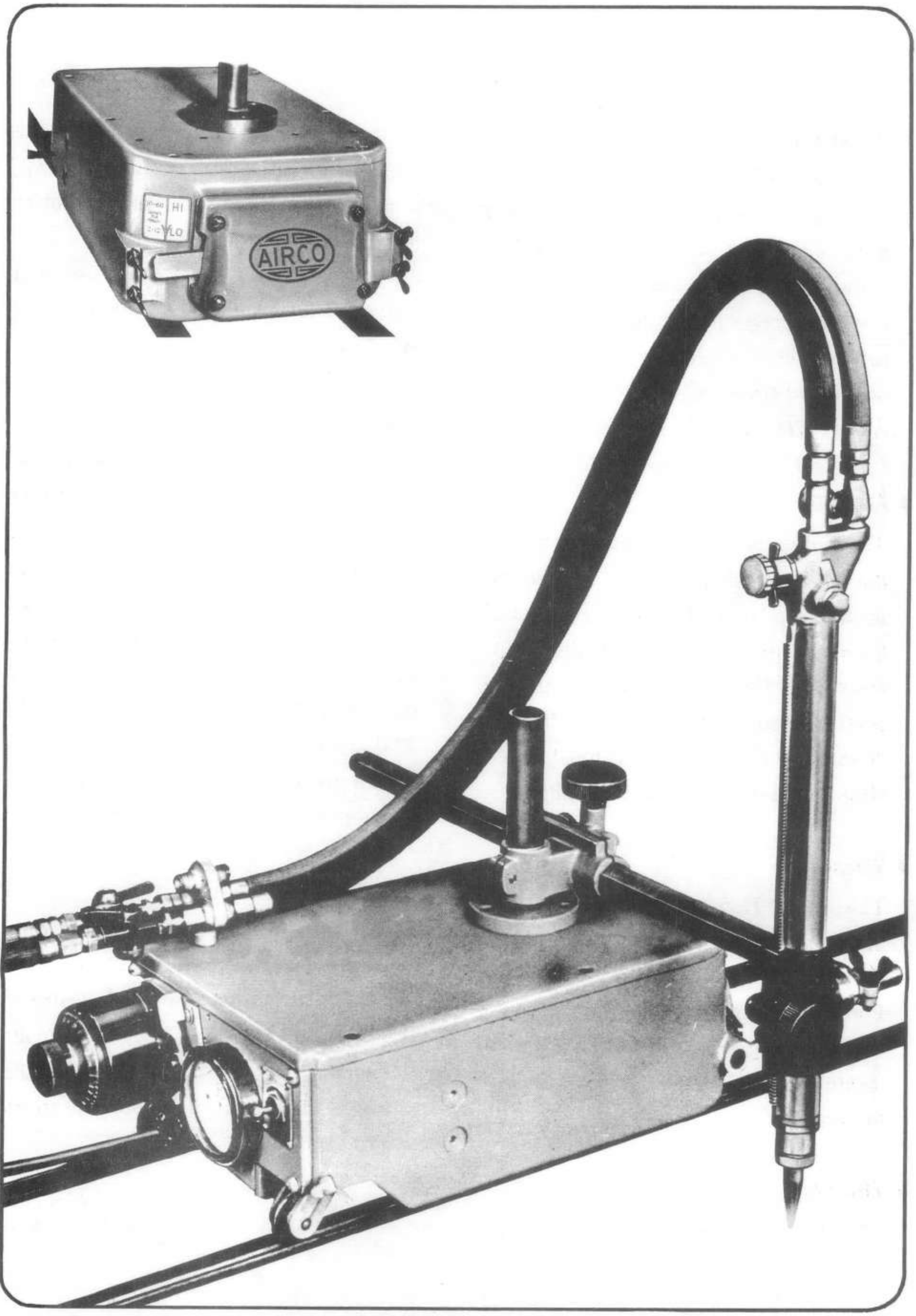
Drive System

The drive motor and governor control unit, equipped with sealed ball bearings, is precision engineered for long, reliable service. All drive system components including motor, governor, tachometer, coupling, receptacle, clutch handle, switch and auxiliary electrical equipment are mounted on a separate base which is easily removed and reinstalled in the machine body to simplify inspection and maintenance.

Controls

Exceptionally precise speed control is attained by the use of the time-proven governor control. Immediately next to the governor control knob is the direct-reading tachometer which tells at a glance the actual speed selected. The speed range of the No. 20 Radiagraph is further extended by the self-contained, grease-packed, transmission providing two speed ranges. Either range is selected by simply shifting the gear shift lever at the front of the machine carriage.

THE AIRCO NO. 20 RADIAGRAPH



- **Portability**

The No. 20 Radiagraph, set up for one torch operation, weighs approximately 65 pounds and can be easily carried to the job and set up by one man. A 3-conductor electrical cord which mates to a male receptacle on the carriage simplifies connection to the required 110 v., or 220 v., A.C. or D.C. electrical outlet.

- **Accuracy**

The No. 20 Radiagraph is guided by large hardened wheels positioned in precisely machined grooves of the track. This guidance system, combined with the lateral stability of the machine carriage and the precise speed control afforded by the governed motor, provide the utmost in machine accuracy and process quality.

- **Versatility**

The No. 20 Radiagraph can be used for many different applications by virtue of the wide range of accessories available. For unusual applications, the flat top of the machine carriage is a most convenient mounting surface for special tools or apparatus.

- **Efficiency**

The convenient grouping of the operator controls at the rear of the carriage make the No. 20 Radiagraph particularly easy to use. Operators are able to do a better job with fewer mistakes, even when a process requires greater attention and control. This means more production per man hour.

- **Reliability**

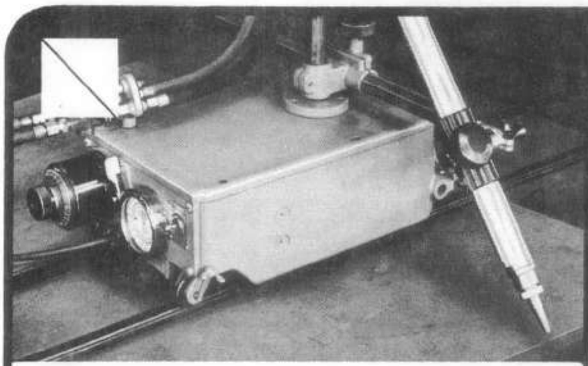
The No. 20 Radiagraph provides the utmost in reliable operation. Packed and sealed ball and needle bearings in motor, governor and transmission insure long, continuing service. All drive elements are totally enclosed by the one-piece bottom casting—protecting them from physical damage, reflected heat and flame wash. Fast and easy removal of the drive package for preventative or corrective maintenance increases total "time on the job".

- **Ruggedness**

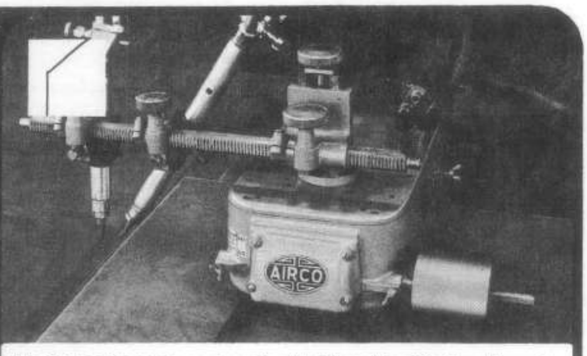
The sturdy aluminum alloy casting, hardened drive wheels, sealed ball bearings, grease-packed drive train and clean external design of the package add up to an extremely rugged No. 20 Radiagraph suitable for operation under the most severe conditions.

Note: For operation and maintenance instructions, see Airco publication ADI-1090-C

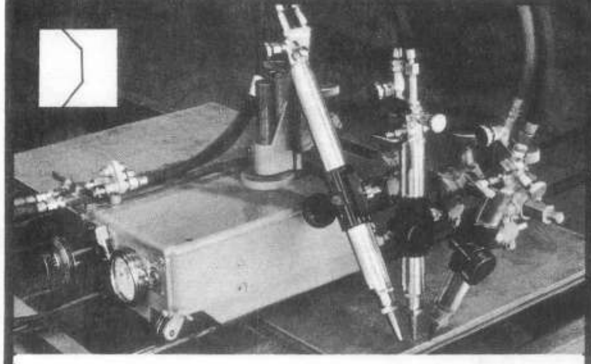
HERE'S WHAT THIS VERSATILE MACHINE CAN DO FOR YOU



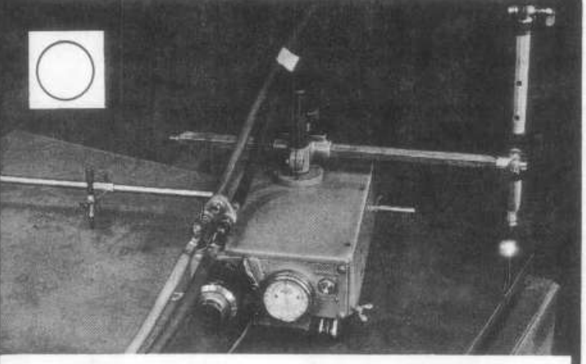
No. 20 Radiagraph set up for cutting a single bevel without a land. Bill of Material No. 8.



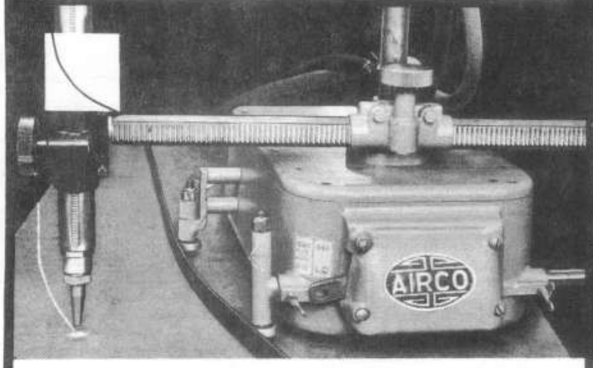
No. 20 Radiagraph equipped with Elevating Device (for raising or lowering both torches 2″ or less simultaneously) and Counterweight Assembly for cutting single bevel with a land. Bill of Material No. 9.



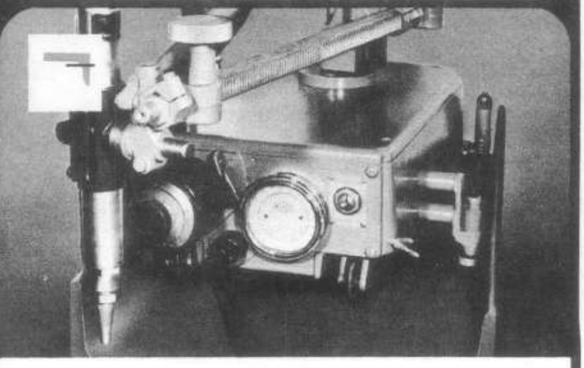
No. 20 Radiagraph set up for cutting simultaneously a double bevel with a land. Bill of Material No. 10.



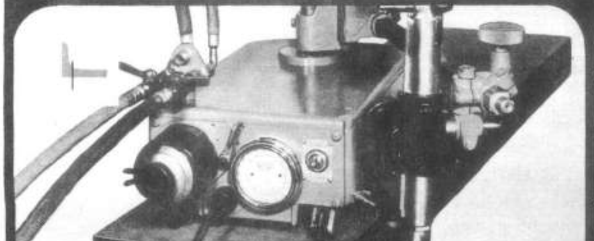
No. 20 Radiagraph equipped with Radius Rod and Centerpoint Assembly for circle or arc cutting. Bill of Material No. 11.



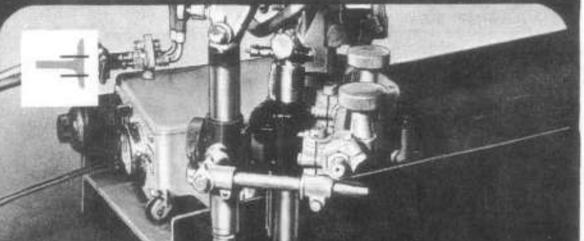
No. 20 Radiagraph equipped with Side Roller Attachments for contour cutting. Bill of Material No. 12.



Removal of Flange. No. 20 Radiagraph set up for cutting one flange from a channel iron—limited to 13½″ min. web width. Bill of Material No. 13.



Notching or Splitting Web. No. 20 Radiagraph in position for working on the inside of channel iron—limited to 15½″ min. web width. Bill of Material No. 14.



Removal of both Flanges simultaneously. No. 20 Radiagraph set up for cutting flanges from an I-Beam—limited to 15½″ min. web width. Bill of Material No. 15.

HOW TO ORDER THE AIRCO NO. 20 RADIAGRAPH AND ACCESSORIES

STANDARD CUTTING MACHINES, FLAME CUTTING SPEED RANGE

No. 20 Radiagraph—(Machine Carriage) for 110 Volt Operation—Stock No. 804-2000
No. 20 Radiagraph—(Machine Carriage) for 220 Volt Operation—Stock No. 804-2020
(Machine Carriage complete with operating mechanism, 25′ of 3-conductor cable, 1⅛″ mounting post, removable top cover and hose bracket, hoses from hose bracket to torch, Radius Rod and Centerpoint Assembly.)

FOR AUTOMATIC ARC WELDING AND PLASMA CUTTING

No. 20 Radiagraph—(Machine Only) for 110 Volt Operation—Stock No. 804-2005
No. 20 Radiagraph—(Machine Only) for 220 Volt Operation—Stock No. 804-2025

		BILL OF MATERIAL							
	Stock No.	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
No. 20 Radiagraph (machine carriage with operating mechanism, 25′ of 3-conductor cable, 1⅛″ mounting post, removable top cover and hose bracket, hoses from hose bracket to torch, Radius Rod and Centerpoint Assembly)—	Order desired type by stock number	1	1	1	1	1	1	1	1
Two Hose Machine Cutting Torch* OR	823-4740	—	1	2	—	—	—	—	2
Two Hose Machine Cutting Torch**	823-2641	—	—	—	—	—	—	—	—
Two Hose Machine Cutting Torch (Optional)***	823-4746	1	1	1	1	1	1	1	—
Cutting Tips (As selected)	854 or 813	(1)5	10	15	5	5	5	5	10
Three-Way Oxygen Hose Conn.	803-0059	—	1	—	—	—	—	—	1
Three-Way Acetylene Hose Conn.	803-0060	—	1	—	—	—	—	—	1
Four-Way Oxygen Hose Conn.	803-0099	—	—	1	—	—	—	—	—
Four-Way Acetylene Hose Conn.	803-0100	—	—	1	—	—	—	—	—
Clamp Assembly	828-4495	1	—	—	1	1	—	—	1
Track—For 5 Foot Cut	838-3658	1	1	1	—	—	—	—	—
Counterweight	838-5585	—	1	1	—	—	—	—	—
Hose and Connections—Oxy.	838-5833	—	—	2	—	—	—	—	1
Hose and Connections—Acet.	838-5834	—	—	2	—	—	—	—	1
Hose and Connections—Oxy.	838-5835	—	2	1	—	—	—	—	2
Hose and Connections—Acet.	838-5836	—	2	1	—	—	—	—	2
Counterweight Rod	838-5973	—	1	1	—	—	—	—	—
Connecting Bar	838-7243	—	—	—	—	—	—	—	1
Torch Holder Bracket Assembly	838-7603	1	2	3	1	1	1	1	2
Elevating Device	838-7604	—	1	1	—	—	1	1	1
Torch Holder Mounting Attachment	838-7605	—	2	3	—	—	1	1	2
Hexagonal Rack	838-7606	1	1	1	1	1	1	1	1
Mounting Bracket	838-7608	1	—	—	1	1	—	—	—
Shut Off Valve—Acetylene	838-8018	1	1	1	1	1	1	1	1
Shut Off Valve—Oxy.	838-8019	1	1	1	1	1	1	1	1
Side Roller Attachments—Front and Rear	838-8573	—	—	—	—	1	1	1	1
Torch Head Adapter (For Flange Removal): For Acetylene, or	831-2100	—	—	—	—	—	1	—	2
For Propane or Natural Gas	831-2510	—	—	—	—	—	1	—	2
Wrench	809-0028	1	1	1	1	1	1	1	1
No. 7 Lubricant—(1¼ lb. Can)	832-9907	1	1	1	1	1	1	1	1

*For use with acetylene.
**For use with Natural gas or propane.
***For use when extra torch length required.
(1) See Catalog Sheet 813, ADC 872

ORDERING THE NO. 20 RADIAGRAPH AND ACCESSORIES FOR AUTOMATIC ARC WELDING OR PLASMA CUTTING

Part or Unit	Stock No.	Function
No. 20 Radiagraph (bare) of desired type	804-2005 804-2025	1 unit suited to power requirements
Post Assembly with Installation Screws	838-8572	1 unit for equipment mounting
Mounting Bracket	838-7608	1 unit to connect post to rack
Hexagonal Rack—24 in. long	838-7606	1 unit for mounting additional equipment
Torch Holder Clamp	828-4495	1 unit to attach rack to holder
Torch Holder Bracket Assembly	838-7603	1 unit to hold and adjust torch barrel
Track—6′ 4″ long for 5′ 3″ travel	838-3658	as required
Radius Arm and Center Point Assembly	828-8670	if required for welding circles or arcs from 2″ to 8′ 8″ dia.
Six-way Wrench	809-0028	1 unit for each Radiagraph
No. 7 Lubricant (1¼ lb. can)	832-9907	1 unit for each Radiagraph

SPECIFICATIONS

No. 20 Radiagraph	Power Requirements	Speed Ranges (in./min.)
804-2000	110 v, 60 cycle, single phase, or 110 v DC	Lo: 2-12 Hi: 10-60
804-2005	110 v, 60 cycle, single phase, or 110 v DC	Lo: 8-48 Hi: 40-240
804-2020	220 v, 60 cycle, single phase, or 220 v DC	Lo: 2-12 Hi: 10-60
804-2025	220 v, 60 cycle, single phase, or 220 v DC	Lo: 8-48 Hi: 40-240

Approximate Weights	Lbs. Net.	Lbs. Gross
Machine Carriage with 25 ft. of 3-conductor cable, Hose Bracket and Torch Holder Post	57	63
Style 4746, 2641 Two-Hose Machine Cutting Torch	3¾	5
Torch Holder Bracket Assembly	1	1¾
Hexagonal Rack	2	3½
Mounting Bracket	1¼	2¼
Radius Rod & Center Point Assembly	3	4½
Track, 6′ 4″ long	15	18

DIMENSIONS

	Length, in.	Width, in.	Height, in.
Machine Carriage	21½	10½	6
Track	76	8	5/16

CUTTING RANGE

Straight Lines — With one section of track	5′ 3″
— Each additional section of track	6′ 4″
Circles	2″ to 8′ 8″ dia.
Arcs	1″ to 4′ 4″ rad.

For further information, call your local AIRCO Distributor listed in the Yellow Pages under "Welding Equipment & Supplies"

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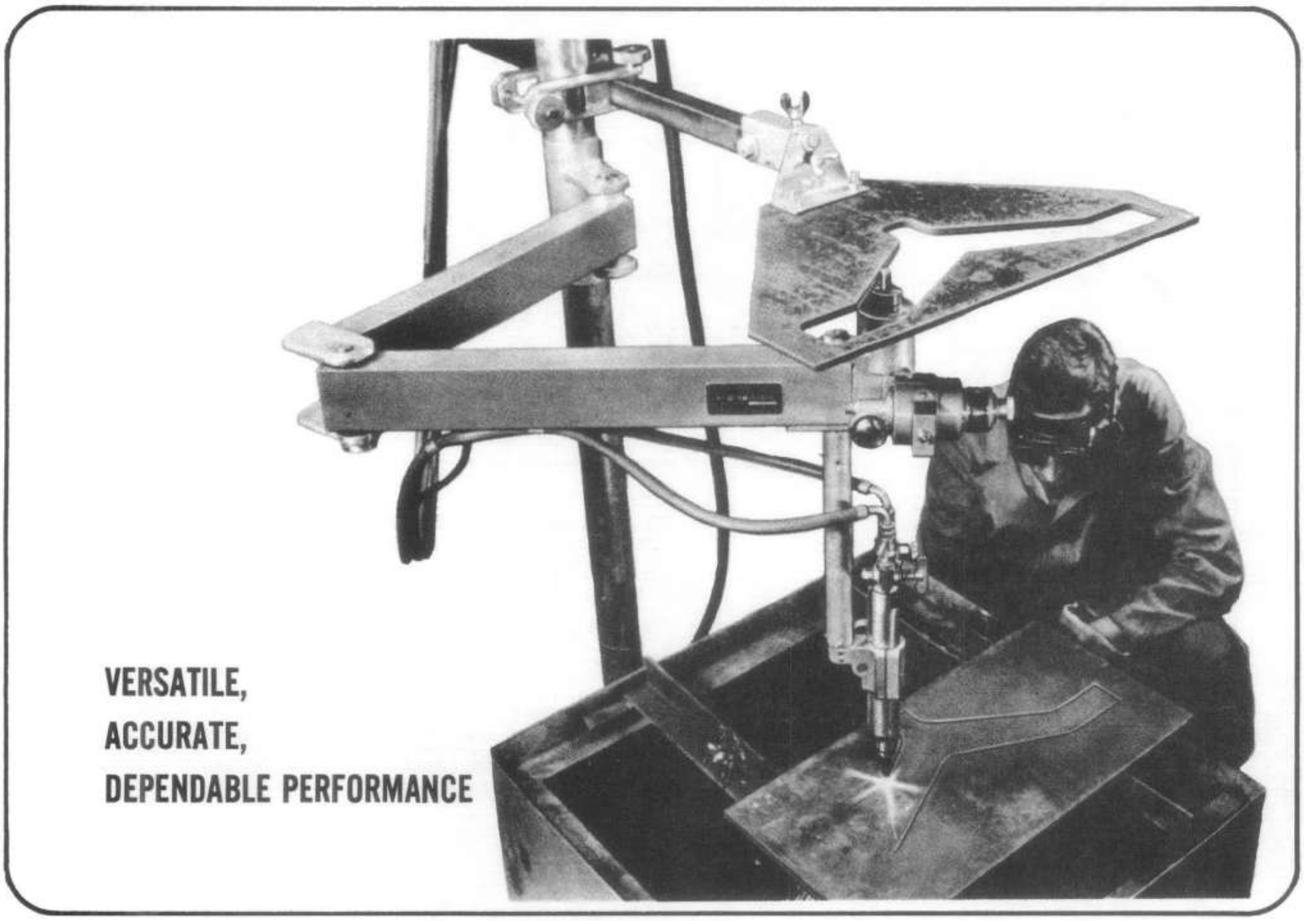
Printed in U.S.A.

10-75-3M-518

AIRCO®

42 Camograph

Shape Cutting Machine Designed for Accurate, Repetitive Production

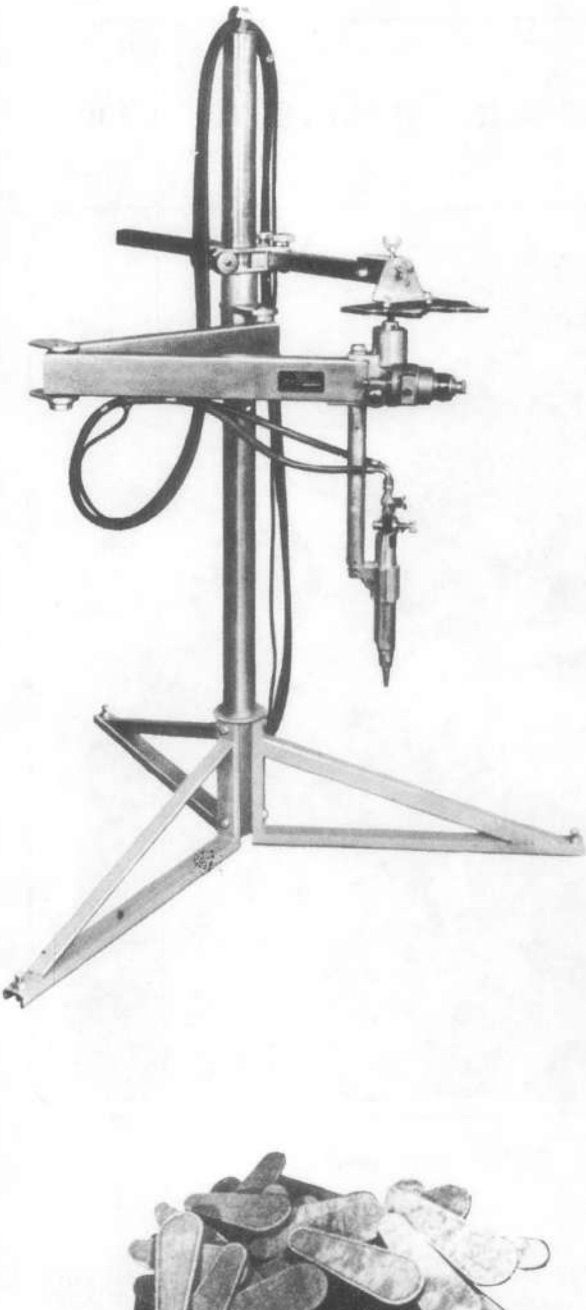


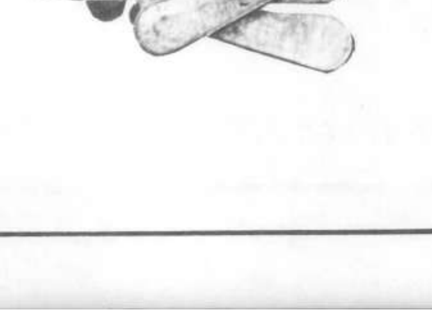
CUSTOMER ADVANTAGES

- Portable.
- Versatile, accurate and economical to operate.
- Supplements larger cutting machines freeing them for larger work.
- Cuts from either inside or outside templates.
- Sealed, permanently lubricated ball bearings are used in the pivots of the arm assembly.
- No exposed rails to rust, collect dirt and overload the driving motor.
- Instant, step-less fingertip control of cutting speed while motor is running or stopped.

For Operating Instructions and Parts see ADI-1203

NOVEMBER, 1969
SUPERSEDES OCTOBER 1959





DESCRIPTION

The Airco No. 42 Camograph is a compact, versatile flame cutting machine designed for accurate repetitive production. When equipped with a suitable cam it will automatically flame cut identical shapes from steel sheet or plate for production runs of any quantity.

Capable of cutting practically any required shape, this precision machine has an ample cutting range that permits production of the large majority of parts likely to be required of the average metal shop. It will cut any shape that falls within a 42 in. diameter circle.

Versatile, accurate, and economical to operate, the No. 42 Camograph is required equipment for every modern metal working or fabricating shop. In the large shop it is ideal for supplementing the production of larger area flame cutting machines, thereby freeing the larger machines for other, larger work.

The No. 42 Camograph is essentially a hinged swinging-arm-type machine consisting of an arm assembly pivoted at its support and at its center. Inertia in the arm assembly is minimized by its tubular aluminum construction and by the use of permanently lubricated sealed ball bearings for the pivots of the arms.

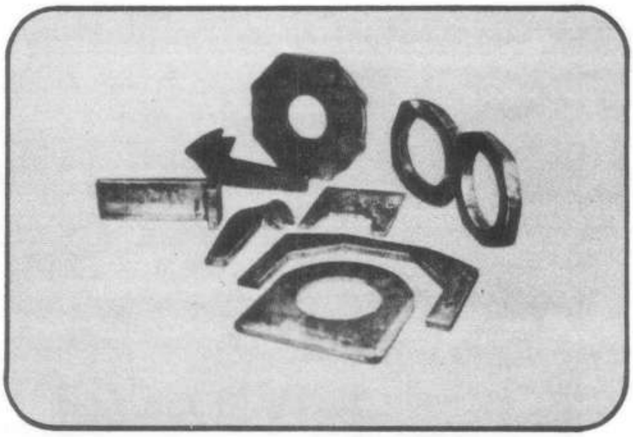
A cam of the shape to be cut is fastened to a rigid support arm above the arm assembly by means of an adjustable cam holder. This cam acts as the guide for the knurled tracer roller. A permanent magnet in the tracer head provides magnetic traction between the knurled tracer roller and the cam. The roller engages the cam and thereby controls the movement of the torch through the medium of the arm assembly to which both cam roller and torch are rigidly attached, with their centers on the same vertical axis. Both the cam support arm and the arm assembly are firmly mounted on a vertical tubular steel column. Three sturdy legs at the base of the column provide machine stability. Levelling screws with lock nuts in each leg provide a quick means for levelling the machine.

Use of extruded aluminum and steel tubular construction make the 42 Camograph more than adequately strong, yet so light that it is easily transported, fully assembled, to work areas throughout the plant.

The adjustable speed, reversible tracer motor, which controls the cutting speed in conjunction with the diameter of roller used, is of the same type used with the more expensive cutting machines. The motor speed is governor controlled and can be selected by means of an indexed speed control that enables the operator to quickly reproduce the speed he requires time after time. A positive worm gear drive transmits power to the tracer roller with no lost motion. No belts or pulleys are used.

VERSATILITY

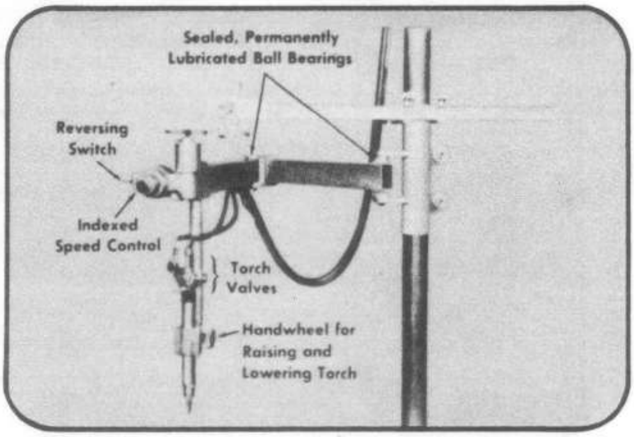
- The No. 42 Camograph will cut most shapes encountered in the metal working shop.
- It will cut metal up to 12 in. thick.
- Cutting speeds are adjustable over a wide, practical range.

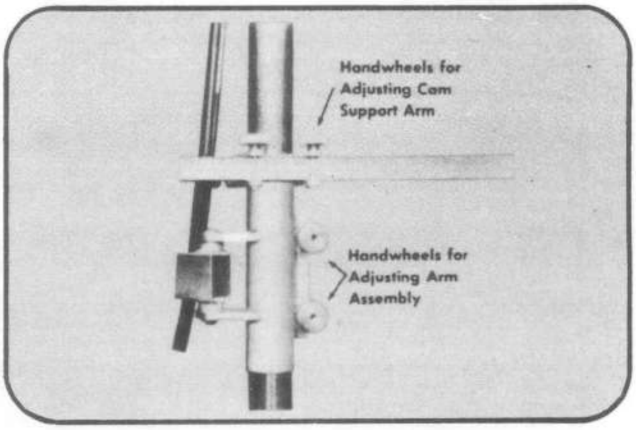


EASY OPERATION

Simplified controls, all conveniently located at the end of the operating arm make the Camograph one of the simplest shape cutting machines to operate.

- *Indexed Speed Control* of the reversible motor enables instant, fingertip cutting speed adjustments to be made before starting or with the motor running, thus permitting the increase or decrease of torch travel in progress. This feature is particularly advantageous in starting and finishing cuts. By simply turning the Indexed Speed Control in one direction or the other, the desired lineal speed is quickly established.
- *Reversing Switch* starts tracer motor operation and enables travel in either direction.

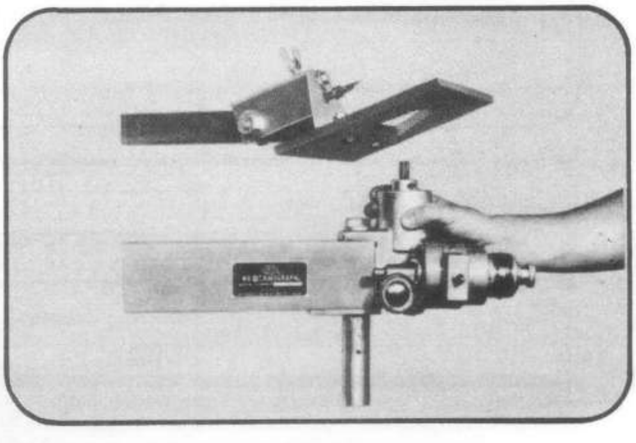

Sealed, Permanently Lubricated Ball Bearings
Reversing Switch
Indexed Speed Control
Torch Valves
Handwheel for Raising and Lowering Torch


Handwheels for Adjusting Cam Support Arm
Handwheels for Adjusting Arm Assembly

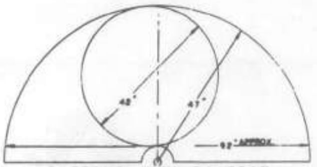
EASY ADJUSTMENT

- Handwheels on the arm assembly bracket clamp and on the cam support arm clamp, provide easy means for positioning the cam and the torch anywhere over the cutting area, at the exact height desired.

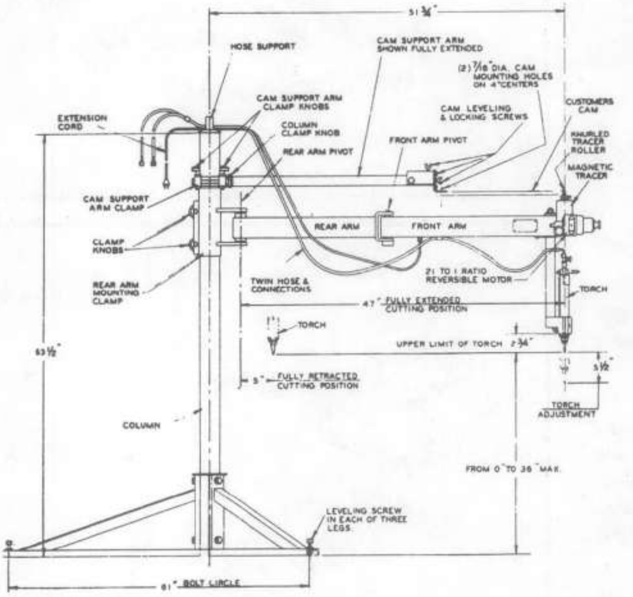
- Provision is made for convenient levelling of the cam in two directions, 90° apart, and also for tilting the cam to remove the roller from an internal cam.



SPECIFICATIONS



CUTTING AREA DIAGRAM



CUTTING SPEED RANGE

Roller Dia.	Speed Range (in. per min.)
½" (Standard) 828-9717	3 to 30
⅜" (Optional) 838-9723	2 to 22
¼" (Optional) 838-9722	1½ to 15

MATERIAL THICKNESS CAPACITY

Roller Dia.	Metal Thickness
½"	¼" to 12"
⅜"	¼" to 12"
¼"	¾" to 12"

AREA CAPACITY

See Cutting Area Diagram

MOTOR

Governor controlled reversible motor, 115 V., 25, 50 or 60 cycles, AC

MAGNET

Specially designed long life permanent magnet

WARRANTY

The No. 42 CAMOGRAPH is warranteed against defects in material and workmanship for 1 year.

WEIGHT

Net weight: 140 lb. approx.
Shipping Weight: 200 lbs. approx.

HOW TO ORDER

Quantity	Description	Stock No.
1 each	No. 42 Camograph consisting of: Machine Assembly with ½" dia roller and 25' of 5/16" Twin Hose W/Connections	804-4200

To complete the above package, order torch & tips appropriate for fuel gas used.

FOR ACETYLINE — 1 each – Two hose machine cutting torch 823-4700 and style 138 cutting tips

FOR NATURAL GAS OR PROPANE (over 3 psi pressure)
1 each – Two hose machine cutting torch 823-4700 and style 263 cutting tips

FOR NATURAL GAS OR PROPANE (under 3 psi pressure)
1 each – Two hose machine cutting torch 823-2610 and style 263 cutting tips

FOR MAPP GAS — 1 each – Two hose machine cutting torch 823-4700 and style 264 cutting tips

For further information, call your local AIRCO Distributor listed in the Yellow Pages under "Welding Equipment & Supplies"

AIRCO Welding Products
A Division of Airco, Inc., P.O. Box 486, Union, New Jersey 07083
Offices & Distributors in Principal Cities • Airco International Dept.

Printed in U.S.A.
10-73-5M-539

AIRCO®

NO. 5 PIPE CUTTING and BEVELING MACHINE

The No. 5 Pipe Cutting and Beveling Machine is designed to cut or bevel pipe from 4" to 12" (10 to 30 cm) in diameter. An optional 6-link set may be added to the chain for each 2" (5 cm) increase in pipe OD over 12" up to 36" (90 cm).

The use of a sheet metal template 8-11/16" (22.0 cm) wide strapped around the pipe between the carriage wheels will assure correct alignment of the end of the cut with the starting point when cutting large diameter pipe.

The machine, cranked by hand, moves an oxy-fuel cutting torch around the outer wall of a pipe on four wheels. The torch (not provided with the machine) is mounted in an adjustable torch holder on a rack. This permits horizontal, vertical, and angular positioning to cut a square or bevel edge. Two torches may be mounted on an optional 24" rack to cut out small sections of pipe (rusted on threaded couplings, breaks, faulty welds.)

DISTINCTIVE FEATURES

Rugged construction – built to withstand hard and constant usage.

Versatile – will cut and bevel a large variety of pipe sizes up to 36" – adaptable for either single or two torch operation.

Portable – easily handled and operated by one man – weighs less than 40 lbs.

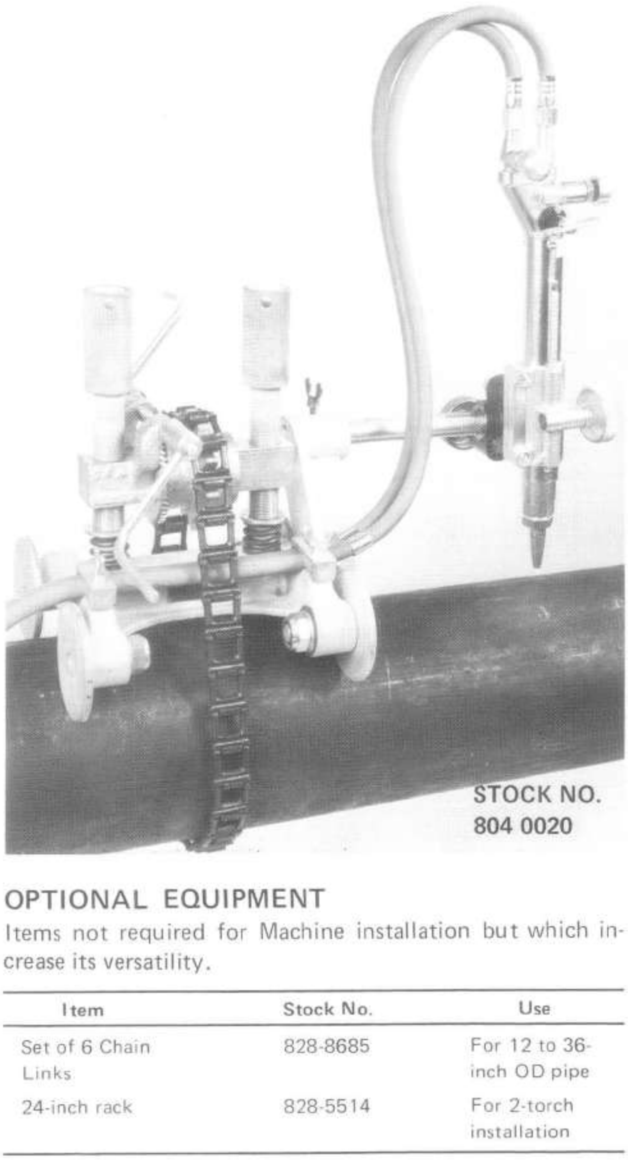
Accurate – performs a clean-cut, mechanically accurate job, leaving pipe ends square with pipe axis, free from burrs, slag and scale – ready for welding without further attention.

Easy to use – quickly set up, adjusted and operated for a straight cut or any desired bevel.

AUXILIARY EQUIPMENT

Items required to complete an installation– torches and tips–are listed according to the fuel gas used.

Fuel Gas	2-Hose Torch	Tip Style
MAPP® Gas	823-4700	264
Acetylene	823-4700	144
Propane or Natural Gas below 5 psig	823-2610	261
Propane or Natural Gas 5 psig or more	823-4700	261



STOCK NO.
804 0020

OPTIONAL EQUIPMENT

Items not required for Machine installation but which increase its versatility.

Item	Stock No.	Use
Set of 6 Chain Links	828-8685	For 12 to 36-inch OD pipe
24-inch rack	828-5514	For 2-torch installation

For Instructions and Parts, See ADI-1760.

JUNE 1976
SUPERSEDES: APRIL 1975

HOW TO ORDER

FOR SINGLE TORCH OPERATION – BILL OF MATERIAL #1
FOR TWO TORCH OPERATION – BILL OF MATERIAL #2

DESCRIPTION	STOCK NO.	BILL OF MAT'L #1	BILL OF MAT'L #2
#5 Pipe Cutting & Beveling Machine	804 0020	1	1
Two Hose Machine Cutting Torch	As Selected	1	2
Cutting Tip	As Selected	1	2
3-Way Oxygen Hose Connection	803 0059	–	1
3-Way Acetylene Hose Connection	803 0060	–	1
24" Rack	828 5514	–	1
Torch Holder	838 7603	–	1
Adjustable Swivel Shaft Holder Ass'y.	828 6148	–	1
6-Way Wrench	809 0028	1	1
1/4" or 5/16" Twin Hose & Conn. Ass'y. ("B" Conn.)	Length as Desired	1	2

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6-76-8M-244

AIRCO®

TENSILE TESTING MACHINE

APPLICATIONS

This machine is used chiefly at work-sites where it is essential that the strength of welds be tested daily to determine the operator's ability to deposit sound weld metal. Because of the machine's portability, it can be transported right to the job site where actual testing is required. Thus, qualification tests for welding operators can be expedited by being performed on the spot, eliminating the time and expense needed to ship test specimens to distant test laboratories.

Its versatility and low cost also makes the machine well suited for many bench mounted applications.

FEATURES

- Portable—can be used right at the job site.
- Versatile—can perform three standard types of tests used on welds.
- Can also perform tension and bend tests required by API-AGA Standard 1104, using accessory equipment.
- Accurate to plus or minus 2%.
- Auxiliary hand on the gauge maintains its indication of the actual load under which the specimen fails.
- Durably constructed.
- Easy to use.
- Low in cost.

DESCRIPTION

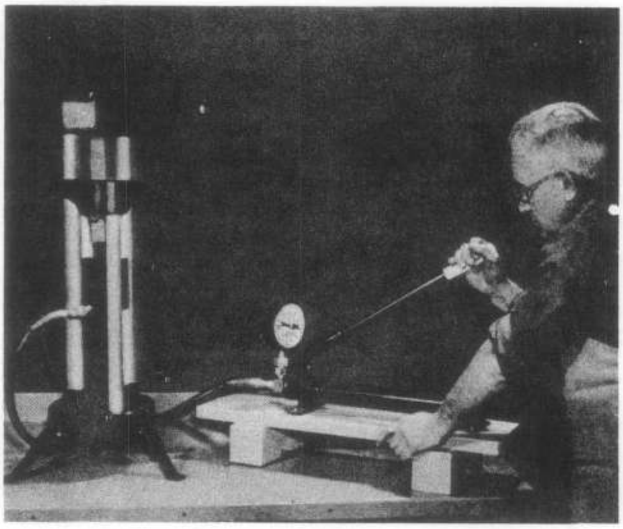
With the standard equipment provided, this Airco portable testing machine can perform the following:

1) Guided bend tests (root bends, side bends, and face bends) on 3/8" thickness specimens with a 2t bend.

2) Transverse tension tests on 3/8" thickness specimens of 1¾" maximum width.

In addition, guided bend tests can be made on ½" thickness specimens on a 3½t radius, per API-AGA Standard 1104, using a bending jig and anvil assembly available as accessory equipment.

Also, the machine can make longitudinal all-weld-metal tension tests on test specimens of 0.505" in diameter, by the addition of two test specimen jaws and couplings available as accessories.



The standard machine is shipped in a compact, portable hardwood container in which each part has a specific place. Also supplied are three small strap iron legs to raise the machine off the floor or bench.

To actuate the machine, pressure is built up by manually operating the handle of a small hydraulic pump. The pump pulls down a movable head on tension rods away from a fixed or stationary head. A large, easily read gauge shows "Pounds total load" as applied to the specimen, and is accurate to plus or minus 2%. An auxiliary hand, which is carried along by the gauge pointer, remains at the point of maximum load after the pointer returns to zero upon failure of the specimen. Thus the operator knows the actual load under which the specimen has failed.

With a few strokes of the handle, the operator can apply a direct load of up to 40,000 pounds on a cross-sectional area up to 1½" x ½". By using specimens of smaller area, loads equal to 150,000 psi or higher can be applied. Therefore, with these reduced-size specimens, the whole range of various types of steel can be tested by this quick and easy method.

For Instructions & Parts, See ADI-889C

MARCH 1970
SUPERSEDES APRIL 1963
PAGES 200 AND 201

To perform the three standard types of bend test (face bend, root bend, and side bend), the plunger which is part of the machine is attached to the machine's movable head. The test specimen is then placed between the plunger and an accurately machined test die, also supplied. The pump's action pulls down the plunger toward the fixed head of the machine, thus bending the intervening specimen the required 180°.

To perform the transverse tension test, the plunger and (in some cases) the die are removed. Toothed jaws are inserte into the two heads, and the specimen placed between th jaws. The specimen is then pulled apart by the action of the ram, operated by the hydraulic pump.

To perform the longitudinal all-weld-metal tension tests (0.505"), accessory equipment (two jaws and two cour lings) must also be used.

SPECIFICATIONS

Machine	
Height (exclusive of pump legs)	30¾"
Diameter of machine body (max.)	9½"
Diameter of base (circle outside feet)	19½"
Stroke	5"
Capacity (direct load)	40,000 lbs.
Weight (machine and accessories)	166 lbs.
Weight of cabinet	70 lbs.
Gross shipping weight	264 lbs.

Tensile Test Specimen	
Max. thickness	½"
Max. width	1¾"
Length	9"–10"
Max. Direct Load	40,000 lbs.
Bend Test Specimen	
Standard thickness	3/8"
Standard width	1½"
Length (max.)	6½"
Angle of bend (max.)	180°

HOW TO ORDER

Item	Remarks	Description	Stock No.	Qty.	Price Each	Total Price
1	Order one for bending 3/8" specimens on 2t radius	Portable tensile and guided bend testing machine	804-0203			
2	Order 2 of each for all-weld-metal tension test (0.505")	Test specimen jaw	838-0130			
		Test specimen coupling	838-0131			
3	Order one for bending ½" specimens on a 3½t radius	Bending jig and anvil assembly	842-1142			

For further information, call your local AIRCO Distributor listed in the Yellow Pages under "Welding Equipment & Supplies"

AIRCO Welding Products

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Airco International Department, P.O. Box 281, Union, New Jersey 07083

AIRCO®

POWDER CUTTING AND WASHING EQUIPMENT

AIRCO PNEUMATIC TYPE METALLIC POWDER FEEDER

804-3600

PNEUMATIC POWDER FEEDER

APPLICATION:

For feeding iron powder in the oxy flame cutting of high alloy steels.

ADVANTAGES:

1. Simultaneous two torch operation from one Powder Feeder
2. Uniform feed - density of feed can be easily adjusted to suit conditions
3. Different feed rates from two outlet lines can be maintained
4. Constant feed rate whether hopper is full or almost empty
5. Simple antibridging construction prevents powder packing
6. Heart of feeder is made of non-rusting, long wearing material
7. Inductor assembly is removable for inspection or replacement
8. Hopper top can be easily removed for recharging
9. Hopper cover has gas-tight seal with hand tightening
10. Feeder is fitted with relief valve to avoid the over-pressurizing of torches
11. Brass screen keeps out large particles and foreign matter
12. Envelope of desiccant material keeps the powder in the hopper dry
13. The unit comes fitted with handles so it may be carried loaded or unloaded

DESCRIPTION

The Airco Pneumatic Type Metallic Powder Feeder may be used with the identical accessory equipment designed for use with the vibratory type feeder to feed the required amounts of metallic powder into the cutting zone. The metallic powder is carried in an air or nitrogen stream.

The Airco Model 50 Pneumatic Type Iron Powder Feeder is designed to feed iron powder uniformly to two outlet lines simultaneously. Dual feeding is accomplished by two individual powder inductor assemblies. Equalization of powder from the two lines is assured. Different feed rates from the two lines can be accomplished when needed.

SPECIFICATIONS
Airco Pneumatic Type Metallic Powder Feeder
804-3600

Hopper Capacity: Approx. 50 lbs. Airco No. 5 Metallic Powder

Size: 6" cylindrical body 34" high stands within 20" circle

Weight: Approx. 32 lbs. net; 60 lbs. shipping weight

Air Requirements: 75 cfh at 40 psi for single outlet; 150 cfh at 40 psi dual outlet.

POWDER CUTTING AND WASHING EQUIPMENT

HOW TO ORDER

Powder Cutting and Washing	Description	Stock No.
1	Pneumatic Powder Feeder	804-3600
1	Air Dryer	*838-9606
1	Air Regulator	*806-9957
1	25 ft. 3/8" Hose and Connections (from Air Regulator to Feeder - See Note B)	*842-0210
	**When Nitrogen OP is used omit the last three items and order the following Regulator and Hose Assembly instead:*	
1	Nitrogen OP Regulator (no Air Dryer required)	806-8424
1	25 ft. 3/8" Hose and Connections (from Nitrogen Regulator to Feeder - See Note B)	842-0211
1	25 ft. 3/16" Hose and Connections - For Single Torch (from Feeder to Torch - See Note B)	842-0245
2	25 ft. 3/16" Hose and Connections - For Two Torches (from Feeder to Torch - See Note B)	842-0245
	NOTE B - Hose lengths listed are those recommended. Longer lengths can be ordered by stating exception on order. When hose from Feeder to Torch is required in excess of 25', order 1/4" diameter hose 908-1008. Also include 2 Air-Water Hose Conn. Nut 803-0254 and 2 Glands 803-0246.	

Refer to form ADI 1201 for Operating Instructions and Repair Parts for the 804-3600 Pneumatic Powder Feeder.

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under "Welding Equipment & Supplies"

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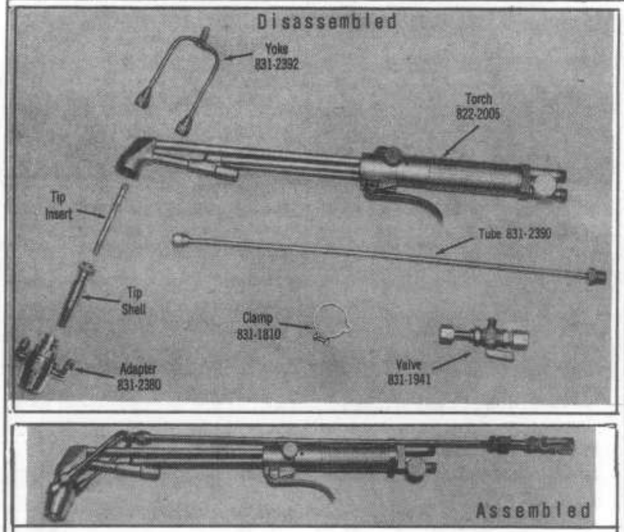
Airco International Department, P.O. Box 281, Union, New Jersey 07083

IRON POWDER TORCH ACCESSORIES

APPLICATION

For feeding iron powder into the cutting oxygen stream to permit the quality cutting of high alloy steels.



822 2005 Hand Cutting Torch with Accessory Unit 831 2382 for Propane or Natural Gas.

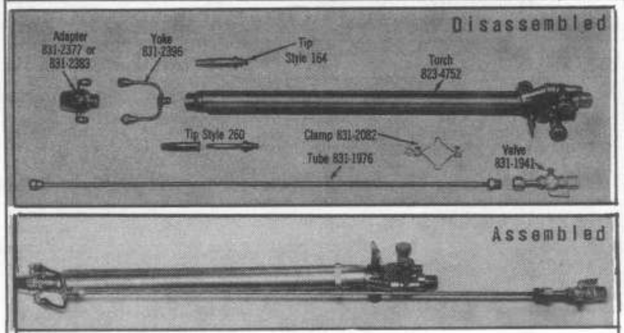
ADVANTAGES

1. Double entry feature provides uniform powder distribution.
2. Adaptor is made from stainless steel for lasting service.
3. Adaptor can be taken apart for cleaning.

DESCRIPTION

The nitrogen or air powder stream from the Pneumatic Feeder is fed to the torch through flexible rubber hose and an on-off feed is controlled by shutoff valve. From the valve, the gas powder stream is fed through a stainless steel tube to a yoke located at the head end of the torch. A clamp is provided for attaching the tube to the torch barrel. A double entry adaptor, of two piece construction, surrounds the tip and receives powder from the yoke.

During the cutting process, a uniform flow of powder enters the kerf. This results in the generation of heat which offsets the retarding of action of the alloying metal.



823 4752 Machine Cutting Torch with Accessories for Acetylene, Propane or Natural Gas.

IRON POWDER TORCH ACCESSORIES

HOW TO ORDER TORCH ACCESSORIES

HAND TORCH OPERATION

TORCH	TIP	ASSEMBLY-CONSISTING OF: ⟶	ADAPTOR	YOKE	TUBE	CLAMP	VALVE	SPACER
822 2005	250	831 2382	831 2380	831 2392	831 2390	831 1810	831 1941	NONE
822 2365	250	NONE	"	"	831 1977	"	"	"
822 9515	†	831 2379	831 2377	831 2392	831 2390	831 1810	831 1941	831 2376
822 9535	†	NONE	"	"	831 1977	"	"	"
822 9515	260	831 2385	831 2383	"	831 2390	"	"	NONE
822 9535	260	NONE	"	"	831 1977	"	"	NONE

MACHINE TORCH OPERATION

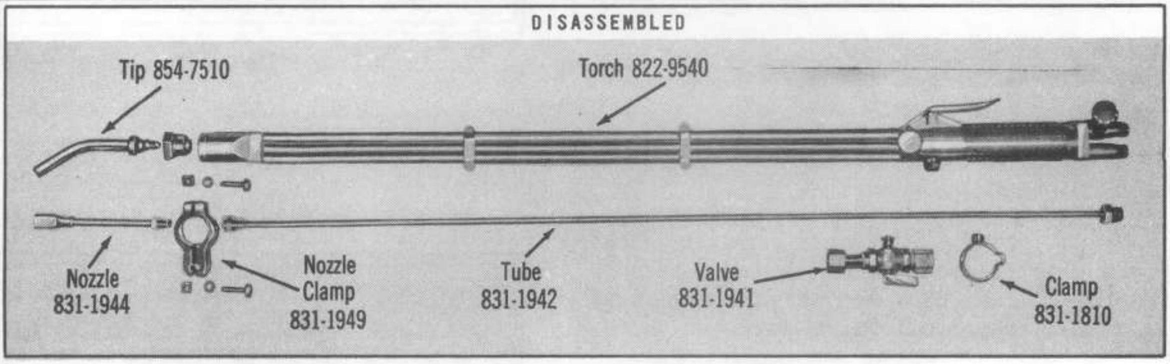
TORCH	TIP	ASSEMBLY-CONSISTING OF: ⟶	ADAPTOR	YOKE	TUBE	CLAMP	VALVE	SPACER
823 2561	250	831 2381	831 2380	831 2396	831 1977	831 2082	831 1941	NONE
823 4722	†	831 2378	831 2377	831 2396	831 1977	831 2082	831 1941	831 2376
823 4752	†	NONE	"	"	831 1976	"	"	"
823 4722	260	831 2384	831 2383	"	831 1977	"	"	NONE
823 4752	260	NONE	"	"	831 1976	"	"	NONE

REFERS TO 124, 144, 164 & 138 TIP STYLES

POWDER WASHING

TORCH	TIP	ASSEMBLY-CONSISTING OF: ⟶	NOZZLE CLAMP	NOZZLE	TUBE	CLAMP	VALVE
822 9540	854 7510	831 1945	831 1949	831 1944	831 1942	831 1810	831 1941

DISASSEMBLED



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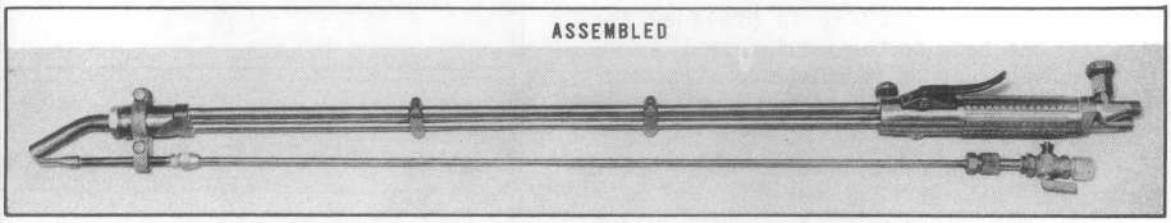

822 9540 TORCH WITH ACCESSORY UNIT 831 1945 FOR POWDER WASHING.

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ADC 846 PRINTED IN U.S.A.

12-60-7M-6545

AIRCO ELECTRICALLY HEATED CARBON DIOXIDE REGULATOR

CO_2 FLOW PROBLEMS

1. Solid CO_2 particles (Dry Ice) clog flow control orifice causing sharp fluctuations in CO_2 flow which results in improper weld shielding and gas porosity. Flow is also restricted or reduced on applications other than welding.
2. Freeze-up that involves the formation of solid CO_2 during expansion which causes the moving parts of the regulator to cease functioning.
3. Seat failure due to contamination from foreign matter such as water and oil entrained in the gas or the diffusion of CO_2 into the seat material.

THEORETICAL SOLUTION TO PRIMARY PROBLEM.

The expansion of a gas through an orifice from a high inlet pressure to a low outlet pressure is accompanied by a refrigeration effect. This cooling does not cause solidification of most gases since they do not form stable solids under ordinary conditions. However, carbon dioxide has a stable solid state known as dry ice which is readily established under suitable conditions. Significant accumulations of dry ice are formed when CO_2 gas is expanded from cylinder pressures above 950 psig (cylinder temperature above 79°F), to ordinary use pressures. The problem is magnified when high flows are required since increasing the flow causes more dry ice to be formed. The Style 8005 electrically heated regulator traps the dry ice formed during the expansion and vaporizes it before it reaches the flow control orifice so that clogging of the orifice does not occur.

REGULATOR DESIGN. This regulator is basically a standard single stage regulator. However, it has an improved seat design and employs a teflon seat which is compatible with carbon dioxide. A special seat retainer is employed in this CO_2 regulator because the main flow path has been diverted through the diaphragm cavity in order to increase the area available for heat transfer.

A 115 volt 1.3 amp. heating system includes three 50 watt heaters, a control thermostat, and a safety cutout. Normally, the heaters cycle to maintain the regulator body temperature between the control limits of 95 and 120°F at the thermostat sensing point. Under conditions of maximum heat demand, i.e., inlet pressures over 950 psig, and at flow rates over 60 cfh, the heaters will run continuously, and the regulator may even frost up on the external surfaces. The presence of this frost is normal and does not indicate a regulator "freeze-up."

The style 8005 carbon dioxide regulator is supplied with two gauges. One gauge measures cylinder pressure and is graduated in psi (gauge). The second gauge indicates delivery flow (in scfh) by measuring the pressure (psi-absolute) within the regulator. This type of flow measurement is accomplished by inserting a flow control orifice in the regulator outlet connection.

The orifice is sized so that the flow rate is numerically equal to the absolute pressure upstream from the flow orifice. The second gauge is graduated in absolute pressure so that one scale can be used to measure both regulated pressure and flow. If gauge pressure reading is desired, it is always 15 psi less than absolute. The location of an orifice downstream from the pressure gauge means that the outlet pressure (absolute) is indicated only under non-flow conditions. If delivery pressure is desired under flow conditions, a gauge must be inserted downstream from the regulator. The regulator flow gauge is designed to be a simple, rugged flow indicator for general welding use. At flow rates above 25 cfh, the overall accuracy will be within 10% of indicated flow, an accuracy more than adequate for welding service.

It must be understood that this type of flow measurement is only correct if there is adequate pressure drop across the flow controlling orifice. This will normally be the case even with our most flow-restrictive welding equipment. If there is any question of whether high back pressure is restricting flow, this can be checked as follows:

◆◆◆◆◆

a. Install a test gauge between the regulator outlet connection and the distribution system.

For Instructions and Parts, See ADI - 1545

JUNE 1971
NEW ISSUE

b. Take pressure readings from the test gauge and from the regulator operating gauge at the flow rate in question.

c. Use the following ratio formula to calculate the pressure ratio R.

$$R = \frac{\text{outlet pressure (psig)} + 15}{\text{operating gauge flow (psia)}}$$

d. Use Table I to determine accuracy of regulator flow indicator operating gauge.

TABLE I – RATIO FORMULA TABLE

R	ACTUAL FLOW (PERCENT OF INDICATED FLOW) (%)
0.53 or less	100
0.6	98
0.65	96
0.7	93
0.75	88
0.8	81

EXAMPLE I: Flow = 100 cfh (100 psia), and test gauge pressure = 30 psig.

$$R = \frac{30 + 15}{100} = 0.45$$

Since R = 0.45 is less than R = 0.53, flow = 100 cfh and regulator operating flow gauge is correct.

EXAMPLE II: Flow = 100 cfh (100 psia) and outlet pressure = 60 psig.

$$R = \frac{60 + 15}{100} = 0.75$$

Since R = 0.75, Table I indicates that actual flow is 88% of indicated flow or 88 cfh.

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LESSON PLAN

SUBJECT: POSITIVE ACTION PLAN

OBJECTIVE: To take an overview of shared Sales Experiences and Ideas and convert them into a Positive Action Plan.

REFERENCES: Product Information Class 8 text

TRAINING MATERIALS:
Survey Form Class 8,
OSHA Compliance Check List,
Transfer of Learning Notes — 1 and 2
THIS IS YOUR PLANNED SALES CALL
SUPPLEMENTARY MATERIALS:
  Pad of Survey Form Class 8
  Pad of OSHA Compliance Check List

PRESENTATION:	This session is called Positive Action Plan. The purpose is to review the sales experiences and ideas recorded during the sessions on Transfer Learning into Selling and utilize this information when preparing to make calls on all accounts.
HAVE PARTICIPANTS REMOVE *NOTES* ON TRANSFER LEARNING INTO SELLING 1 AND 2	Now that you have been through this training program on gas regulating, welding, and cutting apparatus, you will have "new eyes" to observe your customer's needs and to help you *sell class 8 products.*
REVIEW THE SURVEY FORM CLASS 8	We have included a *Survey Form Class 8* to be used to analyze your customers' equipment and applications. A pad of these forms is available for your use. (Supplementary material)
REVIEW THE COMPLIANCE CHECK LIST	We have also provided an O.S.H.A. Compliance Check List related to the Material presented in this training program. You will be able to determine if your customer complies. A pad of this compliance check list is available for your use. (Supplementary material)
REVIEW THIS IS YOUR PLANNED SALES CALL	On the next page is your planned sales call.

THIS IS YOUR PLANNED SALES CALL

PLAN TO MAKE YOUR CALL WITH THIS SALES CALL OBJECTIVE.

I. OBJECTIVE:

To check the customer's equipment and applications related to the use of gas regulating, welding and cutting apparatus.

II. PRESENTATION

Airco recently held a Product Information Session on gas regulating, welding and cutting equipment. I received a survey form which will help me to analyze your plant for an equipment update.

You may have old equipment that could be replaced with an AIRCO product which would be more efficient and, therefore save you time and money. I also received an OSHA Compliance check list which will let you know whether you comply to OSHA standards, in the area of gas regulating, welding, and flame cutting equipment.

SHOW SURVEY FORM AND COMPLIANCE CHECK LIST. OBTAIN CONSENT TO COMPLETE THEM.	The survey will be for my use; however, I'll leave the check list with you.

III. ACTION

A. Complete survey and OSHA check list

B. Discuss OSHA check list with the customer indicating any non-compliance. Leave check list with the customer.

C. Review the survey form and discuss the customer product needs.

D. TRANSFER LEARNING INTO SELLING!!

AIRCO Welding Products

SURVEY FORM CLASS 8

CUSTOMER ______________________________ DATE ______________

LOCATION ______________________ SALES PERSON ______________

PRODUCTS MANUFACTURED ______________________________

____

APPLICATIONS: (Check)
CUTTING ________ GAS WELDING ________ BRAZING ________
SPRAYING ________ HEATING ________ HARDENING ________
OTHER (NAME) ______________________________

GASES: (Check)
OXYGEN ________ ACETYLENE ________ MAPP GAS ________
NATURAL GAS ________ CO_2 ________ ARGON ________
OTHER (NAME) ______________________________

MATERIALS: ______________________ THICKNESSES ______________

CONSUMPTION:
OXYGEN PER MONTH ______________________ CU. FT.
ACETYLENE PER MONTH ______________________ CU. FT.
MAPP GAS PER MONTH ______________________ CU. FT.
OTHER ________ PER MONTH ______________________ CU. FT.

GAS REGULATING, WELDING AND CUTTING APPARATUS CURRENTLY BEING USED:

I. REGULATORS

MANUFACTURER	STYLE MODEL STOCK #	QUANTITY	CONDITION		
			# GOOD	# FAIR	# POOR
1. Airco					
2.					
3.					
4.					

II. TORCHES

MANUFACTURER	STYLE MODEL STOCK #	QUANTITY	CONDITION		
			# GOOD	# FAIR	# POOR
1. Airco					
2.					
3.					
4.					

III. TIPS (Cutting, Heating, etc.)

1. Airco					
2.					
3.					
4.					

IV. OTHER (Manifolds, Hose, etc.)

1. Airco					
2.					
3.					
4.					

CUSTOMER PRODUCT NEEDS

ITEM	QUANTITY	STOCK #	DESCRIPTION	UNIT PRICE	AMOUNT
1.					
2.					
3.					
4.					

AIRCO Welding Products

OSHA COMPLIANCE CHECK LIST
Occupational Safety and Health Standards
(Title 29 Code of Federal Regulations Part 1910 June 1974)

Reference OSHA pages 23738 - 23741 relating to **Gas Apparatus and Supplies**, and Compressed Gas Cylinders. This check list does not include all Gas Apparatus and Supplies, Additional Information available upon request.

Requirement	Complies		Remarks
	Yes	No	
1. Gas Apparatus & Supplies 1. Oxygen regulator **gauges** must be marked "USE NO OIL."			Airco gauges so-marked.
2. Fuel Gas Manifolds (a). Inside building-capacity of a single manifold shall not exceed 3000 CF of fuel gas or 300 lb. of liquid petroleum fuel gas. (b). More than one manifold may be in the same room provided manifolds are at least 50 ft. apart or separated by non-combustible barrier 5 ft. high with 1/2 hr. fire-resistance. (c). Manifolds exceeding capacity of (a) above must be located outdoors or in special rooms or buildings. (d). Cylinders must be manifolded in a vertical position. (e). UL or FM approved flash arrestors must be installed between each **acetylene** cylinder and the coupler block (or header). **Outdoors** when not more than 3 cylinders coupled can use only one flash arrestor, installed between regulator and block. (f). For other **fuel gases** UL or FM approved back flow check valves must be installed between each cylinder and coupler block (or header). No flash arrestor needed.			Airco Arrestors are approved: 801-0091 acet. } 1" Pipe 801-0101 other fuels } 801-0093 acet. } 1½-2" Pipe 801-0102 other fuels }
3. Oxygen Manifolds (a). Inside building-capacity of a single manifold shall not exceed 6000 cu. ft. More than one such manifold may be in the same room provided manifolds are 50 ft. apart or separated by 5 ft. tall non-combustible barrier having 1/2 hour fire-resistance rating. (b). An Oxygen manifold or more than 6000 cu. ft. capacity must be located outdoors or in separate non-combustible building. If other occupancy in building must be located in separate non-combustible room and in area where combustibles are not less than 20 ft. from manifold.			
4. Hose (a). Hose showing leaks, burns, worn places or other defects must be repaired or replaced. (b). Generally recognized hose colors – red for acetylene and fuel gas, green for oxygen and black for inert gases and air.			Airco hose conforms.
5. Personal Protective Equipment (a). Where hazards are present personal protective equipment for eyes, face, head and extremities, protective clothing, protective shields and barriers shall be provided, used and maintained in sanitary condition.			(Airco spectacles & goggles conform. Jackson Products face shields, welding helmets and goggles comply.)

Requirement	Complies		Remarks
	Yes	No	
(b). Except when performing light work, all welders shall wear flameproof gauntlet gloves. (c). **Aprons** used for welding may be leather, asbestos or other suitable flameproof material. (d). **Capes or shoulder covers** for overhead welding may be made of leather, asbestos or other suitable flameproof material.			(Airco gloves, sleeves, aprons meet requirements)
6. Filler Metals, Electrodes, Fluxes, Welding & Brazing Materials (a). Boxes or other containers used to package filler metals electrodes, fluxes, welding or brazing materials must be provided with tags or labels calling attention to hazardous fumes & gases which may be produced in their use and to safety precautions that should be taken. Special warnings must be provided for materials containing cadmium and fluorides.			(It is standard Airco practice to use prescribed cautionary labeling)
7. Compressed Gas Cylinders (a). Store cylinders in dry, well-ventilated area away from heat, radiators, elevators, stairs and gangways. (b). Keep cylinders at least 20 ft. away from highly combustible materials such as oil, excelsior, etc. (c). Do not store cylinders in unventilated enclosures such as lockers or cupboards. (d). Valve protection caps, where cylinder is designed to take a cap must be in place, handtight when cylinders are not in use or connected for use. (e). No smoking shall be premitted in fuel gas storage areas and a sign should be posted to read: "No Smoking, Matches or Open Lights." (f). Acetylene and other fuel gas cylinders must be stored in an upright position. (g) Oxygen and fuel gases must not be used from cylinders except through pressure reducing regulators. (h). Oxygen cylinders shall be stored at least 20 feet from fuel gas cylinders or other readily combustible materials such as oil, grease, etc. (or separated by a 5 ft. non-combustible barrier having a fire-resistance rating of at least 1/2 hour.)			

LESSON PLAN

SUBJECT: FINAL TEST

OBJECTIVE: To give each participant a final test on all the material covered. Test will be scored by the trainer.

REFERENCES: Product Information Class 8.
Tests on all material covered.

TRAINING MATERIALS: Final Test.

PRESENTATION:

This will be a final test. It covers all the class material.

This test will be scored by me and sent to the Distributor along with your certificate of achievement. Tests will be scored as satisfactory or unsatisfactory.

Before you begin I would like to take this opportunity to thank you for your interest and participation in this training program.

I hope this type of an enrichment program has been of value to you.

ADMINISTER THE TEST. CHECK TO SEE THAT ALL TESTS HAVE NAMES AND DISTRIBUTOR AFFILIATION FILLED IN.

Each participant will leave after completing the test and submitting it to me.

UPON COMPLETION OF THE TEST:
TRAINER, CHECK ANSWERS WITH THOSE PROVIDED.

TRAINER:
CHECK (X) ONLY THE WRONG ANSWERS. INSERT THE NUMBER WRONG AND THE NUMBER CORRECT IN THE SPACE PROVIDED ON THE TEST. MAIL TESTS TO AIRCO WELDING PRODUCTS TRAINING DEPARTMENT CLERMONT TERRACE, UNION, N.J. 07083. WE WILL SCORE THE TEST AS BEING SATISFACTORY OR UNSATISFACTORY AND WE WILL MAIL THE TEST AND THE CERTIFICATE OF ACHIEVEMENT TO YOUR ZONE VICE PRESIDENT FOR HIS SIGNATURE.

THE TEST AND CERTIFICATES WILL BE SENT TO THE DISTRIBUTOR OWNER.

AN [illegible] EST

PRODUCT INFORMATION
GAS REGULATING, WELDING AND CUTTING
APPARATUS — CLASS 8

1. Direct, inverse
2. Pressure, Adjustment
3. 90°, injury
4. Low pressure gauge, deflected
5. Downward
6. Gland, damage
7. Inverse, rising, adjustment
8. Injury
9. Is not, deflected
10. Gland, damaged
11. 9100
12. 8400—9400
13. 15
14. Cannot
15. 1 a. 3 b. 2 c.
16. False
17. True
18. Acetone
19. Simplex, Duplex
20. B.T.U.
21. Heat, work or metal
22. Flow
23. Braid
24. Four
25. Ferrule
26. Tip mix
27. External injector
28. ~~Flashbacks~~ True
29. 1. Victor
    2. Harris
    3. Harris or Victor
    4. Smith
    5. Airco or Smith
    6. Airco
30. True
31. Low pressure
32. Positive, one
33. Separable, separable, tip mixer
34. 16, 17, 18, acetylene
35. Divergent
36. True
37. Feature
    1. Neoprene diaphragm
    2. Dual gas tubes silver brazed
    3. Tip mixing
38. Check valves
39. Divergent
40. Splines
41. Gas mizer
42. 2 a. 1 b. 3 c. 4 d.
43. 200, 50
44. Demand, 3
45. RADIAGRAPH
46. 42 CAMOGRAPH
47. Tensile Testing
48. 12", 36"
49. Kindling Temperature
50. Learning, Selling